NOTES

ON THE

Industries of the United Provinces.

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PREFACE.

In April 1907, the Government of the United Provinces deputed me to enquire into the condition of the local industries and the possibilities of their development. A report based mainly on available written materials, printed and unprinted, supplemented in some cases by personal inquiries and observation, was submitted in the following July. This report was placed before the Industrial Conference that met at Naini Tal in the autumn of last year, and was at the same time communicated to the press. Since then, under the orders of the Government, I have pursued the inquiry by touring through all the industrial centres of the province. I have also had the advantage of going round the principal industrial towns of the Madras Presidency in the company of Mr. A. Chatterton, and have paid short visits to various places in Bengal, the Central Provinces, Western India, Rajputana and the Punjab. The preliminary report has been almost entirely rewritten. An account of the industrial condition and possibilities of the province is now published in the form of these Notes.

It is necessary to mention that no attempt has been made by me to deal except incidentally with the question of industrial and technical education. An excellent note, treating of the requirements of this province, was written last year by Mr. S. H. Butler, C.I.E., and the subject was discussed in detail at the Naini Tal conference. A definite and comprehensive scheme was drawn up there. General industrial problems—such as commercial training and education, the growth of an industrial press, the fostering of exhibitions, the development of waterways for the carriage of bulky goods and the reorganisation of the banking system of the country—have also been excluded from these pages. Some of these questions have been separately considered by the Government.

In collecting the facts and formulating the suggestions set forth here I have received generous assistance from a very large number of gentlemen, official and non-official, in these provinces and out of it. It will be invidious to mention names. My indebtedness to books and publications will be obvious from the text. Finally, I must acknowledge the constant help and valuable guidance I have received throughout the course of my investigations from Mr. W. H. Moreland, C.I.E., Director of Land Records and Agriculture in these provinces.

ALLAHABAD:
The 31st October 1908.

A. C. CHATTERJEE.

TABLE OF CONTENTS.

NOTES

ON THE

Industries of the United Provinces.

Chapter I.—The Cotton Industry.

COTTON is one of the principal commercial crops of the provinces and a staple crop in the western districts. The normal area until recently was, roughly, one million acres, but in 1904-05 and the two following years the area under cotton was much higher than the previous average.* The official figures for 1905-06 and 1906-07 were as below :—

Local of cott

Division.	Area in 1,000 acres. 1905-06.	1906-07.
Meerut	492	480
Agra	434	499
Rohilkhand	122	142
Allahabad	263	282
Kumaun	5	7
Benares and Gorakhpur	2	2
Oudh	44	50

The official estimate of the outturn was 17,95,000 maunds (or 368,000 bales of 400lbs. each) in 1904-05, and 19,21,000 maunds (or 394,000 bales) in 1905-06. The traffic returns of 1905-06, on the other hand, show that 23,31,000 maunds were exported from the province and only 2,87,000 maunds were imported. The net export therefore exceeded two million maunds. If to this quantity be added what was consumed in the province by the hand-spinning machines and the power mills, it is evident that the official estimate of local production must have been much below the actual. The official figures are really conjectural because cotton is often sown mixed with other crops, and an accurate return of such mixed fields is impossible to obtain.

Import cotton.

2. Of the cotton imported, the bulk came from the Punjab, Rajputana and the Central Provinces, which merely indicates the natural movement of trade on the border of the provinces. Bombay port, however, sent to the Allahabad division thirty-four thousand maunds in 1904-05, forty-one thousand maunds in 1905-06 and forty-eight

* The total acreage of cotton in the whole of India in 1905-06 was estimated at 21 million acres with a yield of 3,426,000 bales of 400lbs.—(*Review of the Trade of India* : 1906-07, page 46.) In the following area the estimates were 22¼ million acres and 4,032,700 bales.—(*Ibid*, 1907-08, page 46.)

Sir Harnam Singh Ahluwalia are taking steps to form a company with a capital of twonty-five lakhs to erect at Lucknow a fully-equipped spinning and weaving mill, with a bleaching and dyoing department. The capital of the Mirzapur, Hathras and Lucknow mills is owned almost exclusively by Indians. There is a good deal of native capital in one of the Cawnpore mills.

7. It is interesting to compare the provincial figures with those for the whole of India :—

(*Financial and Commercial Statistics.* Thirteenth Issue.)

1905-06.	Number of mills.	Number of spindles.	Number of looms.	Daily average number of employés.
India ...	204	5,293,834	52,281	212,720
United Provinces	9	316,180	3,471	10,625

As is well known, during the last two years there has been a remarkable growth in the cotton mill industry of the country. At the end of 1907 the number of looms in all India stood at 58,436 (*vide* Annual Report of the Bombay Mill Owners' Association for 1907).

The following statistics are also instructive :—

[Quantity in thousand pounds and the counts of yarn spun in power mills.]

	Nos. 1 to 10.	Nos. 11 to 20.	Nos. 20 to 30.	Nos. 30 to 40.	Nos. above 40.	Total.
1903-04.						
India	147,345	308,659	82,947	16,297	941	556,190
United Provinces, including Ajmer-Merwara.	6,912	22,638	366	8	5	29,930
1904-05.						
India	157,395	288,217	92,101	16,958	1,278	555,948
United Provinces, including Ajmer-Merwara.	6,068	20,626	623	31	...	27,349
1905-06.						
India	194,756	344,013	100,368	15,343	1,139	655,619
United Provinces, including Ajmer-Merwara.	7,507	25,830	945	105	...	34,389
First eleven months, 1906-07.						
India	136,347	326,064	101,001	15,447	1,301	580,219
United Provinces, including Ajmer-Merwara.	7,128	22,930	924	66	...	31,050

8. According to these figures the United Provinces spinning mills may be roughly said to do about 5 per cent. of the total machine-spinning business in India. It is also noticeable that while in the rest of India the tendency was during the last two years to spin the higher counts in preference to the lower ones, this change was not so marked in the United Provinces. This point will be again adverted to later on.

Provincial consumption of yarn.

9. The total approximate consumption of machine-made yarn in the United Provinces may be thus calculated; the figures are for 1905-06:—

Local mill production			34,389,000lbs. or roughly 4,20,000 maunds.
(These figures include Ajmer-Merwara.)			
European twist and yarn imported (mainly through Calcutta) ...			19,000 „
(Exports are negligible.)			
Indian twist and yarn—			
Imports—from Bombay port and province		121	
„ „ Punjab		28	
„ „ Rajputana		27	
„ „ Calcutta, &c.		7	
Total ...			183
Deduct exports—Bengal port		49	
„ „ Punjab		3	
„ „ Central Provinces		4	
„ „ Rajputana and Central India		12	
Total ...			68*
Net imports			1,15,000 maunds.
Total machine yarn consumption			5,54,000 maunds.
Or roughly ...			45,500,000lbs.

The mills of the United Provinces and Ajmer-Merwara wove during the year 1905-06 7,645,931lbs. of goods. Supposing, roughly, they used seven million pounds of yarn (this is a fairly high estimate), about thirty-seven million pounds of machine-made yarn were used by the hand weavers. Even if we exclude the quantity of yarn spun in the Beawar mills in Ajmer-Merwara, I think thirty million pounds may be taken as a safe estimate of the consumption of *machine-made* yarn by the hand weavers of the province. To get a true idea of the hand-loom industry one should add the quantity of hand-spun yarn used, but no approximately accurate estimate of the latter can be made. The census of 1901 gives the number of cotton spinners (excluding partially agriculturists) as males 20,904 and females 65,645, or roughly 86,000 in all. Supposing the average outturn is half a pound a day, and each spinner works about 250 days a

* The Allahabad block (in other words, the Cawnpore mills) sends the bulk of the exports.

year, the outturn is 86,000 × 125lbs. or ten and three-quarter million pounds a year. The census statistics for occupation are not, however, entirely trustworthy.

Provincial consumption of cloth.

10. During 1905-06 the United Provinces imported 7,91,000 maunds of European piece-goods and exported 16,000 maunds. The net consumption of European piece-goods was thus 7,75,000 maunds. The imports of Indian piece-goods amounted to 1,11,000 maunds. The bulk of it may be taken to be machine-made cotton fabrics. The total imports of machine-made goods therefore came to 8,86,000 maunds. The provinces exported 1,07,000 maunds of Indian piece-goods. I do not think it would be an unfair assumption to calculate that one-third of this quantity, or 36,000 maunds, were the product of the Cawnpore mills. The net import of mill cloth may thus be estimated to be 8,50,000 maunds, or roughly seventy million pounds. To this should be added the consumption of local mill cloth. This may be taken as four million pounds. The provincial consumption of mill cloth (locally manufactured and imported) thus comes to seventy-four million pounds.

Extent of the hand-loom industry.

11. We have seen above that the consumption of machine yarn by hand-loom weavers in the province amounts roughly to thirty million pounds. If to this be added hand-spun yarn, the quantity of *cloth* woven by hand looms in the province cannot be less than thirty-seven million pounds. These calculations give one hundred and eleven million pounds of cloth as the total consumption of the province. This is equivalent to about 2·3lbs. per head, which does not seem a very high estimate.

12. It thus appears that the hand looms manufacture at least one-third the quantity (by weight) of the cloth consumed in the provinces. The hand industry can by no means be said to be insignificant.

13. An idea of its magnitude will also be obtained by considering the census statitics concerning the population connected with the industry. The two weaving castes in the province are the Koris, beef-eating Hindus, found mostly in the western districts, and the Julahas (Musalmans), who are spread all over the province. The details are as below :—

Caste.	Total of 1881.	Total of 1891.	1901.		
			Males.	Females.	Total.
Koris	848,422	919,649	518,254	471,773	990,027
Julahas	...	830,231	452,980	445,052	898,032

Not every Kori or Julaha is, however, a weaver and we have therefore to turn to the figures for occupation (table XV of 1701):—

Caste.	Actual workers.				Dependants, both sexes.	Total (workers and dependants).
	Total.		Partially agriculturists.			
	Males	Females.	Males.	Females.		
Cotton weavers (hand industry)	329,789	154,186	23,383	6,237	467,098	947,873
Cotton carpet and rug makers	3,739	316	53	7	5,264	9,319

Thus about half a million of the population earn their livelihood by hand-loom weaving and another half million are dependent on the actual workers.

Prospects of the spinning industry.

14. The factory industries of cotton-ginning, pressing and cleaning as well as the industry of cotton-spinning do not require the help of Government except perhaps for the supply of labour, skilled and unskilled. Turning to the hand industry of spinning, I have not been able to think of any way of encouraging it. No improved head-spinning machine of any value has been discovered, and even such a stout advocate of hand industries as Mr. Havell admits (*vide* Proceedings of the Benares Industrial Conference. 1905) that yarn cannot be made sufficiently cheap by the native hand-spinning apparatus and thinks there is no immediate prospect of improvement in it. He therefore recommends the establishment of more spinning mills. At the same time, for many years to come, a certain proportion of the women of the country will be compelled to earn their livelihood by domestic occupation of the nature of hand-spinning. The question is mainly a social one connected with *parda*, enforced widowhood and similar customs. Such women must work for almost any wages; consequently, unless some more remunerative industry like the use of sewing or knitting machines can be substituted, hand-spinning will not disappear for a long time yet. We have seen above that the net imports of European twist and yarn into the provinces were 19,000 maunds and of Indian twist and yarn 1,15,000 maunds. The total imports were 1,24,000 maunds, or ten million pounds. There is hence considerable room for further enterprise in spinning mills in the provinces even without encroaching on hand-spinning or looking for a market outside the provinces. Moreover, if, either the hand-loom or the power-loom industry of the provinces expanded, there would be an almost unlimited field for spinning mills. The starting of a new

mill at Lucknow is therefore a healthy sign. The most suitable location for spinning mills would be in the Meerut, Agra and Rohilkhand divisions, where the number is at present small compared with the outturn of cotton.

15. As mentioned above, a spinning mill is under construction at Moradabad and I have heard of contemplated mills in other western districts. The progress, however, is not as rapid as one could wish and appears very slow when compared with the great development in the spinning industry in recent years in Bombay and Guzérat. At Ahmedabad, whence the hand weavers of these provinces obtain practically all the medium count yarn (between 25 and 40), nearly all the mills (about forty in number) are owned, managed and officered by Indians. There is no inherent reason why more Indian capital should not be invested in the spinning industry in these provinces. By mentioning above that the best location for spinning mills will be found in the western districts I do not wish to discourage the establishment of such mills in the eastern districts. The Mirzapur mill, I was informed by the courteous managing director, is now doing quite well and extensions are in progress. The disadvantage of distance from the source of raw material will in all probability be counteracted by the advantages of cheaper labour, proximity to coal districts, a damper climate and nearness to the important hand-weaving centres. It may be noted that there is a good deal of hand weaving in all the districts of the Fyzabad, Gorakhpur and Benares divisions. Persons desirous of investigating the prospects of a spinning mill should consult the managers of mills in this province or in Ahmedabad or Bombay, many of whom are willing to give sound advice on receipt of a fee. Mill owners have at present so much foreign competition to contend with that the establishment of a few more mills in these provinces will not appreciably affect them.

Improvements in quality of local cotton.

16. One serious difficulty will, however, have to be faced before there is any very great development in the spinning and weaving industries. The quality of the United Provinces cotton is inferior, and, as we have seen above, only a very insignificant proportion of the yarn spun in local mills is of counts higher than twenty. The local cotton spins up to 16 (and I believe 16½), but for higher counts the mills have to depend on cotton from other parts of India or from foreign countries. The people naturally have acquired a taste for finer cloths, and it is useless trying to stem the tide by pointing out the greater durability of cloth woven out of the coarser yarns. If therefore it is intended that the local weaving industry (hand-loom or power-loom) should capture any part of the market at present occupied by imported goods, our efforts should be directed to producing a better grade of cotton in the United Provinces.

The Agricultural department has already been working in this direction. Under its auspices, American cotton has been grown by cultivators to a small but increasing extent during the past three seasons. For some time there was a little trouble in keeping the seed unmixed with local or inferior varieties, but this difficulty has been practically overcome. This year (1908) a large acreage has been sown. Counts of twenty and above have been spun out of the local American cotton. There is now no reasonable doubt that the crop will establish itself if consumers are prepared to pay a price that will recompense the cultivator for the higher cost of production. It behoves all patriotic landholders in the cotton districts of the province to co-operate with the department in this matter.

Difficulties of the power industry.

17. An idea is also prevalent that the climate of the United provinces is not suitable for spinning yarn of high counts. I am unable to speak with any great confidence on the subject, but I have seen in the homes of these provinces fairly fine cloths and saris woven in the Krishna mills at Beawar in Rajputana. Higher grades are also spun and woven in the mills at Nagpur and Ahmedabad. None of these places is cooler than the average town of this province. Subordinate centres—such as Shahjanpur, Bijnor or Moradabad—are not likely to experience any serious climatic difficulty. Humidifying apparatus is extensively used in mills in all countries.* I have been informed by a very reliable authority on the cotton industry that all climatic difficulties can now be surmounted at a comparatively small cost by the adoption of scientific appliances.

18. In conversation with Indian capitalists I have learned that the chief obstacles in the way of the establishment of spinning mills are (1) the very large amount of capital necessary and (2) the scarcity of men with the requisite technical and business experience to fill the position of manager. The first difficulty could be overcome by the formation of small syndicates or limited companies. As regards the second point, native capitalists, not having the advantage of selecting the men on the spot in England, are generally chary of employing any abroad managers whom they can possibly know very little of at the beginning. Similarly capable European managers are not willing to enter the employment of native firms that have not already established a considerable reputation. This is a problem not peculiar to the spinning industry, and will be solved only when the commercial classes of India introduce technical education in the province more generally; a number of properly trained men to occupy such positions. Meanwhile there should not be much trouble in securing men from Western and Central India, where the number of mills is already

* The Bombay Textile Enquiry—Evidence, page [illegible]

operatives,* and education on proper lines will also be conducive to regular attendance and better discipline. If new weaving mills are established in the provinces, I think it would be a mistake to crowd them into Cawnpore. In the east, Allahabad offers a good site for new factories as railway communication now is very good and new railways to Fyzabad, Benares and Jaunpur have placed it within a very easy distance of the congested population of Benares and Southern Oudh. It will also have the advantage of cheaper coal freights and will not be too far from the cotton-growing districts.

ınd looms.

24. Turning to hand-loom weaving, we have seen how more than one-third the *weight* of cotton cloth consumed in the provinces is still the product of the hand industry. It has also been mentioned that a population of quite a million are dependent on hand-loom weaving for subsistence. The hand industry has to compete with local and foreign power-looms and now has to rely to a great extent on imported and mill-made yarn. According to Mr. Johnson of the Cawnpore Muir mills (Paper read at the Industrial Conference in Benares), the comparative costs of weaving a pound of cloth are for a—

	Pies.
Power-loom in England	14
Power-loom in India	17
Efficient hand-loom in India	21

As pointed out, however, by the writer of the Government of India note on *Hand-loom Weaving in India* there are several factors in favour of the hand-loom :—

(1) The hand-weaver's plant represents a small capital and can be kept in use for many years.

(2) The nature and amount of labour requisite for the great variety of design in the more artistic and elaborate garments precludes machine competition in such articles.

(3) The strength and durability of the coarser hand-loom articles recommend them to the cultivator for rough use.

(4) The hand-weaver has a low standard of subsistence, and has also considerable advantage through his inherited skill in the weaving of the finer articles.

* See in this connection the remarks of Mr. S. M. Johnson of the Muir Mills in a paper read by him at the Benares Industrial Conference of 1905 :—

"The greatest disability which affects Indian industries is the poor quality of Indian labour . . . A power-loom weaver in Lancashire works singlehanded from four to six looms, and will turn out from each an average of 78lbs. of coarse cloth in a week of fifty-five working hours or 468lbs. in all for a six-loom worker. A power-loom weaver in (Northern) India looks after, as a rule, only one loom, and all he can turn out of a similar cloth in a week is at the best 70lbs. . . . The difference is due entirely to the quality of the labour."

In all the mills in Ahmedabad one weaver looks after two looms, and sometimes with the aid of a boy three looms.

It has also to be remembered that the hand-weaver often combines the industry with other occupations—notably agriculture. Moreover, working at home in the midst of his own family, he is generally willing to, and does, work much longer hours than an operative at a factory does. The women of the family also in the intervals of domestic work afford a great deal of assistance in the different preliminary processes between the purchase of the yarn and the actual weaving. If hand-weaving were altogether to disappear, only a very small proportion of such women would be engaged in any other industrial employment. These circumstances interfere with the operation, in the case of the hand-loom weaver, of the ordinary economic law of wages, and the comparative cost of the hand-loom product is consequently not so disproportionately large as mentioned by Mr. Johnson.

25. The processes of warping, sizing and weaving followed by hand-weavers in this province are clearly described by Mr. Silberrad in his excellent *Monograph on Cotton Fabrics* (1898).

Distribution of the handloom industry.

26. The handweaving industry is widely distributed throughout the provinces. There is no town and hardly a large village where a few Julahas or Koris are not found plying their hereditary trade. The coarser fabrics (known ordinarily as *garha* and *gazi*) made of yarn of counts lower than twenty are to be met with in all plains districts. The finer cloths are manufactured mostly, but not altogether, in the eastern districts. A moist climate is for obvious reasons better suited to the weaving of fine yarn.

Meerut Division.

27. In the Meerut division there are about a thousand weaver families in the town of Saharanpur and adjacent villages. Only very coarse weaving is practised and with one or two exceptions, I did not see any counts above twenty-two used. The looms are very narrow and hardly any cloth wider than thirty inches is turned out. There is no division of labour in the matter of warping, sizing or weaving. A warp twenty-four yards long by two feet broad takes three days in the preliminary processes and six days for weaving. The outturn is low and so also is the average wage of a weaver, who earns much less than an unskilled earthwork labourer in the district. The *Julahas* of Deoband are more skilful, and weave fairly good *chautais* which have a considerable local reputation. The handweaving in Muzaffarnagar calls for no special observations. In Meerut, there is great deal of weaving in the city as well as in the small towns, but it is all of a very coarse kind and there are no specialities to be noticed. A small proportion of the yarn used is hand spun ; the rest comes from the great yarn market of Delhi. I found in Meerut a good deal of yarn spun in the

Delhi mills. The weavers generally buy ready dyed yarn. In the Bulandshahr district, Sikandrabad is noted for its fine muslin *pagris*. The outturn is not large, but counts as high as 120 or 150 are used and the texture is good. In the neighbouring town of Khurja a much larger quantity of *pagris* is woven, but the quality is not so good as at Sikandarabad. These *pagris* have *kalabatun* edges. The weavers buy the yarn from ordinary dealers. It is usually English yarn imported through Delhi. Local dealers (not necessarily the sellers of yarn) purchase the *pagris* from the weavers, have them washed and calendered and then export to Delhi whence they find their way to the Deccan, where this style of headgear is mostly in use. The consumption of Bulandshahr *pagris* is, I am informed, declining. Means of improvement will probably be found in (1) the adoption of more efficient appliances; (2) getting into direct touch by means of co-operative societies with the sellers of yarn and the purchasers of the *pagris*. These points will be discussed below. At Khurja there is also woven a very fair quality of *garha* with a close texture. It is sold either unbleached or made into a kind of *kharua* cloth, for which there is good demand in Calcutta and Bengal generally. The dyeing of the *kharua* is done locally, but not with *Al. Patang* (Sappan wood or *Cæsalpinia sappan**) is imported from the Central Indian States, and the cloth is steeped in the infusion obtained by boiling pieces of this wood. The colour is said to be fast. The present processes seem to be very crude. With more scientific methods the industry is likely to prosper. In the Aligarh district a large quantity of *chautais* is woven at Sikandra Rao. The *dari* weaving of Aligarh will be referred to below. The calico printing of Meerut and Aligarh affords a considerable outlet for the hand-made cloth.

ion. 28. In the Agra district, the cloth weavers are almost entirely Koris. Julaha weavers find employment in the manufacture of *daris*. The methods pursued have no special feature. Only very coarse stuffs are turned out and they have a mere local sale. A few men (generally Julahas) weave checks and stripes and also handkerchiefs, but their number is insignificant. The hand-weaving of Muttra does not require comment. The well-known prints of Muttra and Brindaban are of mill made cloth. In the town of Etawah, the coarser weaving (counts from 10 to 24) is the monopoly of Kori weavers. There is also a large settlement of Julahas (estimated roughly at about four hundred families) who go in for weaving moderately fine cloth. A favourite fabric is the *doryu* (a thin stuff of loose texture requiring yarn of forty counts). Another local product is *deg* (a fine check, the warp being forty double and the weft

* See Hadi's Monograph on Dyes and Dyeing, p. 78.

twenty-four double). At one time a considerable quantity of *dhotis* used to be woven, but this branch of the trade has declined owing to the competition of mill cloth. The weaver generally buys ready dyed yarn except in the case of blues and blacks which are locally dyed with vegetable indigo through the agency of the *rangrez* (professional dyer). The Turkey red yarn comes, I was informed, from Madras. In Etah and Mainpuri there are no centres of the weaving industry worthy of note. In Farrukhabad, the bulk of the printing is done on fine mill cloth. The conditions of the hand-weaving industry are the same as in Etawah. A small proportion of hand-spun yarn is used. The consumption of the hand-made cloth is entirely local.

Rohilkhand Division.

29. Turning to the Rohilkhand division, Nagina, Najibabad and Dhampur are the chief centres of hand weaving in the Bijnor district. In Nagina the number of weaver families is estimated at four hundred. The principal product is *garha*, for which mill yarn of sixteens and twenties is mostly in requisition. The cloth is used locally, but some portion is exported. I found *garha* from Nagina utilised by the calico-printers of Katra in the Gonda district for the *dogas* or *razais* of that place. A fair quantity of checks and stripes is also woven at Nagina for which yarn from thirties to forties is required. The yarn dyeing is all local. With the exception of indigo for blue and black, only the inferior aniline dyes are used and the results are admittedly fugitive. The Nagina weaver does not take an advance of yarn from the dealer, but purchases it outright, keeping a running account with him. The daily earnings of the weaver hardly ever exceeds three annas and a good many have elected other means of livelihood. At Najibabad and Dhampur the features of the industry are the same as at Nagina. There is a certain amount of export to the Garhwal hills. Otherwise the cloth is locally consumed. The town of Moradabad is one of the principal centres of the hand-weaving industry in the provinces. The Kori population is small, but it is surmised that the number of Julaha families well exceeds one thousand. There are very few men who employ other Julahas on daily or contract wages. Nearly every man works on his own. I could not find any system of division of labour except that some men devote themselves entirely to the art of preparing healds and passing the warp through healds preparatory to weaving. They have acquired considerable practice and command good wages. The weaver purchases yarn from the dealer usually on credit, but the dealer has nothing to do with the woven cloth which the weaver must sell on his own responsibility. He does so either at the market held every evening or to dealers who come from outside. The fabrics

most woven are besides *garha* and *gazi*, checks and stripes of various kinds. Among them may be mentioned the well known *gabrun* (a kind of cheek cloth) handkerchiefs of many hues, *lungis* (men's loin cloths) and *lenhgas* (cloth for women's petticoats or trousers) of diverse patterns. Towels, twills and *dotais* (double threads to make the fabric strong) are made in large quantities. A very large proportion of the plain coarse weaving of Moradabad is used up for the *fards* and *lihafs* (cotton prints) for which the town is famous. The Moradabad weavers are skilful so far as their knowledge extends, but the looms in use are very narrow, the sizing admits of improvement and dyeing is a lost art. Improvements could be effected in all these directions and in the introduction of new and stylish patterns of checks and stripes. The weaving school recently established by Government is likely to make a considerable impression on the hand-weaving industry of Moradabad. The industry at Bareilly is run on much the same lines as at Moradabad, and gives employment to about five hundred families in the city itself. The calico printing industry of Bareilly depends entirely on hand-made cloth. There is nothing noteworthy in the hand-weaving of Shahjahanpur, Budaun or Pilibhit.

Allahabad Division.

30. The Allahabad division has no hand-weaving centre of provincial reputation. Ordinary weaving is practised in all the districts. In Fatehpur the Jafarganj prints are generally of hand-made cloth. Karra in the Allahabad district has a very large number of Julahas ; a good many of them now find employment in the weaving of real and false tinsel lace—an industry imported from Agra. In Jhansi, there used to be at one time a valuable industry in the manufacture of *kharua* cloth at Mau Ranipur. Owing to the competition of chemical dyes, the art has completely disappeared. The total area under *al* (*Morinda citrifolia*) is now reported to be four acres, and even these fields have not been worked during the last four or five years. A fair quantity of weaving is still to be found in Jhansi town. There are about two hundred families of Koshtas. Mill yarn is exclusively used because, I was given to understand, the yarn dealers refused to keep a sufficiently varied stock unless the weavers gave an undertaking to abjure hand-spun yarn altogether. The yarn used, even black and blue, is imported ready dyed. The fabrics woven vary from coarse *chautais* for which counts from sixteen to twenty are used, to *dhotis*, *saris* and *lehngas*, which require yarn between forties and sixties. Some Deccani turban cloths with gold thread (usually imitation) ends are also manufactured. Fine yarn of hundred counts or higher is required for these. The looms in use are very narrow and the warping processes are primitive. For sizing, the meal of a kind of yam is most in requisition. In the

Hamirpur district, a speciality is made of a kind of quilt cloth. The other districts of Bundelkhand are almost entirely agricultural and there is nothing else worth recording about hand weaving in the Allahabad division.

Benares Division.

31. Benares is perhaps the best known weaving centre in the provinces, and the weavers there are undoubtedly the most skilful artisans I have come across, but they confine themselves almost entirely to the manufacture of silks of various kinds. Cotton weaving is carried on in two or three small centres in the Benares district, but the outturn is insignificant. In Mirzapur there used to be a large quantity of ordinary coarse weaving, but it is declining owing to many of the Julahas having recently taken up carpet weaving. In Jaunpur, a large number of weavers is settled in the village of Terhwa, about six miles from the city and very fair qualities of plain cloth are turned out. The yarn used in the district is practically all mill-made, and I seldom came across counts higher than forties. In Ghazipur and Ballia the conditions are very much the same as at Jaunpur. In the north of these districts the influence of the neighbouring town of Mau (Azamgarh) has been felt, and there is some weaving at Bahadurganj in Ghazipur of fine muslin *pagris* for sale in the Mahratta country. Similarly in two or three centres in Ballia, cloth is manufactured for export to the Nepal terai, similar to the Tanda and Mau trade.

Gorakhpur Division.

32. In the Gorakhpur division there is a good deal of plain weaving, but nothing noteworthy, in the Basti district. The same remark applies to Gorakhpur itself. Azamgarh, on the other hand, is distinguished for the extent of the industry as well as the skill of its weavers. About twenty years ago it was estimated that Mubarakpur had 1,700 looms, Mau possessed 1,200, Kopaganj had 500, and ten other villages had a hundred to five hundred looms each. The industry has much declined in recent years. Plague has been very severe in Azamgarh during the last six or seven years and the weaving community has suffered most. The rise in the price of yarn during the last two or three years combined with unfavourable agricultural seasons has also hit the Azamgarh weavers very hard. In Mubarakpur the chief products consist of silk and cotton unions which will be mentioned in the chapter on silk. The consumption of Azamgarh satin has fallen, and many Mubarakpur weavers have been compelled to take to weaving cotton handkerchiefs and *pagris*. Muslins requiring yarn from sixties to hundred or above are still largely woven in Mau. In some cases the weft is silk. The staple product of Mau is now the *dakhini pagri* for sale in the Mahratta country. Many varieties of this article in red or white are woven, but of the great bulk, the texture is loose and the cotton of low counts. The loom in use for these *pagris* is very

narrow. The quality of the *pagris* is considerably inferior to that of the Bulandshahr article mentioned above. *Dhotis* and *saris* for local use as well as for the Deccan districts are woven in large numbers. The yarn for the inferior articles is dyed at home with aniline dyes. Where fast colours are desired ready dyed yarn is purchased. Some checks and stripes also are manufactured at Mau, but they are of a very coarse type. The circumstances of the industry are the same at the other centres in the Azamgarh district. The yarn is supplied at Mau by ordinary dealers, who import it from Cawnpore or Calcutta. The dealers in yarn seldom take back the cloth. Some of the leading weavers have small factories where they employ five to ten weavers on piece wages. The cloth is sold in the market to dealers, some of whom are also Julahas. These dealers have correspondents in Cawnpore, Poona, Hyderabad, Nepal, Calcutta, etc. In some cases there are branch shops in those places. The weavers in Azamgarh are at present in a very depressed condition and special efforts will be necessary to restore the industry to its former prosperous level.

:know Divi- 33. Fine muslins were at one time a special product of Lucknow, but I could find little trace of any high grade weaving there during my investigations. Power loom cloth is now exclusively used for *chikan* work as well as for the well-known *fards* (quilt covers) of the town. Some coarse weaving of the ordinary kind is carried on in different parts of the city and in adjacent towns, but the requirements of the city in hand-made cloth have to be met by imports from the neighbouring districts of Sitapur and Bara Banki. In the Rae Bareli district the weaving of the coarser fabrics (counts of ten and sixteen) is confined to the Koris. The looms are worked at a very low speed and the weaver earns barely three annas a day. The Julahas weave counts from twenty to forty. The favourite fabrics are coloured checks and stripes (known variously as *zarbatan*, *susi*, *sangi*, etc.). There are about fifty families in Rae Bareli town and two hundred in Jais. Although the daily wage of the Julahas is better than that of the Kori weavers, they seem to be entirely in the hands of money-lenders. In the town of Jais an old man (Madar Bakhsh) has a considerable skill in weaving figures, letters and flowers in fine muslin. He has his loom up three flights of stairs in a mudbuilt house and jealously guards his art from being copied even by his own relations. With the sole exception of this man, no one in the Rae Bareli district now weaves *jamdani* or fine muslin. In the Sitapur district there is a good deal of coarse weaving in various parts, but there is nothing special to record. The same remark applies to the remaining districts of the division, *viz.* Kheri, Hardoi and Unao.

Fyzabad Division.

34. The district of Fyzabad is one of the principal centres of the hand-weaving industry in the provinces. The population of the thriving town of Tanda is almost entirely made up of weavers, dyers and cloth printers. The weavers are all Julahas. A small quantity of *jamdani* (a fine hand-woven figured and damasked fabric) is still woven, especially as borders for caps, but with the change in the sartorian taste of the Indian upper classes, the demand for this fabric is steadily falling. The insertion of the pattern has to be done simultaneously with the weaving as in weaving carpets. Two and sometimes three weavers work at the loom, one of them being the chief. The pattern is woven entirely from memory. The finished product is sold locally to dealers and in some cases the weaver himself takes his ware round to the taluqdars of the province. I saw counts up to one hundred and eightly used for *jamdani*. White muslin *pagris* are woven in large quantities, yarn of counts up to one hundred and twenty being required. Silk borders are often provided for these *pagris*. The weavers informed me there was a great demand nowadays for fine muslin *dhotis* and *saris* and other styles of fine cloth like the Mau muslins. Many weavers who formerly made *jamdani* have taken to the manufacture of this kind of fabric. One of the chief products of the Tanda looms is a striped fabric known as *girant*. These are usually made of dyed yarn (40 to 60 counts) and are about 42 inches wide and six yards long. There is a great sale of these in the Nepal Terai and the north of Bahraich, Gorakhpur and Basti districts. Among the other fabrics of Tanda are Marathi *dhotis* and *saris*, *dakhini pagris* (only small quantities), and medium quality *dhotis* and *saris* for local consumption. A fair quantity of bedsheets, counterpanes and coloured check bedspreads is woven for local needs. These articles if pushed are likely to have a good sale all over the provinces. Checks and stripes for coats and shirtings are also being manufactured now. Some of them are of pleasing patterns, but the sale is limited and they seem to be little known outside the district. In the town of Tanda there is a large proportion of master weavers who employ a number of journeymen weavers earning from three to five rupees a month and one meal. This is practically a system of small factories, but the owners have no education, enterprise or breadth of conception. Some weavers in Tanda have specialized in the art of sizing, and it is the practice of the master weavers to get the sizing done entirely by these men. Hank sizing is not practised at all. The factory owners as well as the smaller weavers purchase yarn from the dealers in the town. Up to twenties, the yarn comes from the Cawnpore mills. Between twenties and forties, the Ahmedabad mills are drawn from. Above forties, English yarn is used. Dyed yarn is purchased to a very large

extent because the inferior chemical dyes used for local dyeing yield very unsatisfactory results. Sales are made retail at the weekly market or in bulk to the cloth dealers who are not always the same as the yarn dealers. The cloth dealers have either branch shops or correspondents at Cawnpore, Benares and places outside the province. There is no advertising, commercial travelling or market pushing in any form. Weaving is also carried on in other places in the Fyzabad district, *e.g.* Akbarpur and Jalalpur, but on a much smaller scale than at Tanda. The system of work is much the same as at Tanda. There is a good deal of hand-weaving in the Bara Banki district, and some of the hand-made cloth turned out there is utilized for the locally printed *pardas* and quiltcovers. In the Partabgarh district, the best known centre of the hand-weaving industry is Derhwa, a village about twenty miles from headquarters. About six to seven hundred weaver families are settled in a group of villages there. Long warps are the fashion. I saw some warps as long as sixty yards. A large quantity of ordinary coarse cloth (ten and sixteen counts) is woven and also a fabric known as *dhupchaya*. Counts of double forty is used for this article, the warp being red and the weft green. A shot effect is obtained. The red yarn I was told comes from Madras. A few families weave finer stuff, such as checks and stripes, twills, dusters and towels. Some mercerised yarn is also used. Practically all the yarn is purchased ready-dyed. The weavers of the locality possess much skill, but at present suffer from the drawback of a long distance from the Railway which enhances the cost of yarn and prevents anything but a very local sale of the outturn. The hand-weaving of the Sultanpur district calls for no remarks. In Bahraich and Gonda the demand for hand-made cloth is not equal to the supply, for a considerable quantity is imported from the Fyzabad and Bara Banki districts. The calico-printers of Katra in Gonda use cloth imported from Bara Banki and Bijnor.

umaun Divi- n.

35. The hand-made cloth consumed in the hill districts practically all comes from Kashipur pargana in the Naini Tal tarai. About ten years ago it was estimated that three thousand looms were worked in this tract. The country has since been opened out by roads and railways and machine-made cloth is now cutting in to a large extent. Even now, an enormous quantity of coarse cloth (counts of twenty or below) is woven at Jaspur and the adjacent villages. As a rule the cloth is printed in bright aniline colours in the Tanda or Farrukhabad style before sale or export to the hill pattis of Kumaun. Kashipur bazar is the great *entrepôt* for both the handloom and the mill cloth that is now finding favour. The processes of weaving

well-being, which would be an improvement on their present poverty-stricken condition."

37. Nor is it certain that the hand-loom industry is eventually doomed to extinction. The competition of machinery has now existed for nearly three-quarters of a century and the immense financial and scientific resources of power-loom owners have been freely utilized to kill the hand industry, but careful observers are of the opinion that the condition of the weaver is no worse than it was twenty years ago. Mr. Chatterton has recently stated*: "It is very unwise to attempt to predict what is likely to occur in future, but it seems to me that in the struggle between the the hand-loom of India and the power-loom of Europe the latter has nearly reached the limit of its capacity to capture the work of the hand-loom, and that the former may now hope to hold its own in the future and possibly regain a little of what it has lost." It is unsafe to infer from the present miserable state of the weaver classes that they were much better off before power-loom competition began. This was pointed out as long ago as 1890† by Mr. Collin of the Bengal Civil Service, by reference to the writings of Dr. Buchanan Hamilton regarding the cotton-weavers of Maldah and Behar. The factors in favour of the continued existence of the hand-loom industry have been touched on above. Similar causes have led to the survival, and in some cases the revival, of the hand-loom industry in Europe. We need not therefore absolutely despair of the hand-loom industry in this country.

(1) Primary Education.

38. The primary basis of all efforts to aid the hand-weaver should be elementary education with a view to raise the intellectual standard of the community. I have already referred to the difficulty administrators have to contend with among the weavers in connection with sanitary measures. The same shortsightedness pervades their business and industrial ideals. In Benares the weavers of plain Kashi silk admitted to me that they did not desire the introduction of any improved hand-looms because they thought thereby the earnings of individual weavers would be diminished. It is the absolute disregard of business habits, and in many cases the neglect of business honesty, which have made the weavers as a class entirely dependent on the mahajan and the middleman. Mr. Chatterton's* experience in Madras will probably be found true in this province also: "The difficulties which have to be faced lie mainly with the weavers themselves. . . . The weavers object to turning out in a day more cloths than they have been accustomed to, and neither in Salem nor Madras have we

* *Hindustan Review*, March 1907.

† Report on the arts and industries of Bengal by Mr. E. W. Collin, C.S., paragraph 25.

ever been able to get them to make full use of the improved way of working." This remark receives striking testimony from the results of the weaving competitions held in Madras in March 1908. Describing these results Mr. Chatterton says:* " In the paper on the Salem weaving factory (contributed to the Surat Industrial Conference, 1907) figures are given as to the average output of the weavers in that factory, and a comparison with those obtained in the competition shows that when a sufficient stimulus is employed the weaver can without fatigue turn out more than twice as much work as he is willing to do at Salem even when working on liberal piece-work rates. If the Salem weavers would work at the same rate in the factory that they did during the competitions, there would be a good profit on the capital invested." The little experience that we have so far gained in this province in the work of the small weaving schools already started tends in the same direction. The weavers of Moradabad who have added fly-shuttle attachments to their own looms after a training at the school began by turning out a better quality of cloth at a higher speed at their own homes than they did during the last weeks at school when they received a liberal piece-wage. " This is one of the reasons why I am afraid hand-loom factories will have a very uphill struggle. Even the master-weavers of Tanda, who are the proprietors of small factories and carry on a fairly considerable business, labour under the impression that the use of improved looms would vitally affect their interests by cheapening production." I would therefore advocate a very wide extension of primary education among the weaving classes. The Julahas are, as a rule, very orthodox (or I should perhaps say bigoted) Musalmans, and many of them object to sending their boys to schools where all communities are represented. As the weaving castes are in many localities found congregated together, it would perhaps be a good idea at the beginning to start a few schools of the preparatory type for Julahas exclusively. The parents could in such cases be allowed to supplement the ordinary course by lessons in the Quran and the principles of the Muhammadan religion. The Koris are even a more depressed class than the Julahas, and the latter decline to associate with the former. It will be necessary to start separate primary schools for the Koris.

(2) Efficient Looms.

39. We next come to improved appliances and methods. Much has been said and written within the last few years about efficient hand-looms. A good account of the advantages and defects of the various looms then on the market was contributed by Mr. Chatterton to the *Hindostan Review* of March 1907. In a later paper on the Salem weaving factory read at the Surat Industrial conference in December 1907,

* *Indian Trade Journal*, April 9, 1908.

Mr. Chatterton expressed his opinion on the respective merits of the different looms. Regarding the Domestic looms of Messrs. Hattersley and Messrs. Raphael, Mr. Chatterton says that they both involve too hard work for the undeveloped legs of the Indian weaver. They are made of cast-iron and a simple fracture will mean great trouble to the village weaver. " Thirty or forty such looms can be driven by a small oil engine costing not more than Rs. 4 or Rs. 5 a day to run, and there is not the least doubt that the output of these looms will be three or four times as much as when worked by hand-labour. I am inclined to think that small power loom factories of this type might be worked with great success in this country and would afford an admirable training ground for the development of indigenous manufacturing genius." I have not seen a Raphael loom at work, but a number of Hattersley looms were at work last year in a small factory at Cawnpore where Messrs. Allen Bros. are the agents of the manufacturing firm. From what I saw there I entirely endorse Mr. Chatterton's opinion. As regards the Japanese loom, Mr. Chatterton says that no warp ever put into the loom was woven into a satisfactory cloth. He unhesitatingly condemns this loom. When improved looms were first boomed, a number of Japanese looms manufactured at Ludhiana, Khurja and Aligarh was purchased by different persons entirely ignorant of weaving in various parts of this province. These looms never worked successfully for any length of time except at the factory of the late Rai Bahadur Goshain Bhawani Puri of Benares. He had two looms of this type, one imported direct from Japan and another copied locally, at a cost of about Rs. 175. The Rai Bahadur turned out excellent cloth, both cotton and Kashi silk, on this loom and he told me the cost specially in the case of Kashi silk was about half the average cost of production in an ordinary loom. He was a good business man and made the loom pay; but ordinarily I would not recommend the loom for adoption on account of its heavy initial cost, cumbersomeness and the hard labour entailed on the weaver. Only a man of good physique can ply the Japanese loom. The first loom invented by Mr. Churchill has been found very defective for any but the coarsest work, and his second loom, although of great promise, has not yet been perfected or subjected to any extensive tests. Regarding the Triumph loom invented by Captain Maxwell of the Salvation Army Mr. Chatterton did not express any final opinion in the paper above referred to. It has, however, been extensively tried in this province in the schools at Bara Banki, Saharanpur, Moradabad and also at some private factories. For coarse counts up to thirty-threes it has been found a very satisfactory loom. The out-turn in the hands of an expert weaver has exceeded twenty-five yards in eight hours

and the cloth is of a very uniform texture. Kashi silk (plain or ordinary stripes) and mercerized cotton are also woven with great ease on this loom. The loom is, however, useless for any fine weaving. The chief point against it is the excessive cost. A frameloom with all necessary accessories costs about a hundred and fifty rupees to set up in these provinces. This sum is altogether beyond the means of an ordinary weaver and he is not willing to buy the loom even on a system of exceedingly easy payments. The cottage loom sold by the Salvation Army is of the same type, the frames being replaced by posts fixed in the ground. This loom is much cheaper, but the outturn is comparatively poor and more labour is involved. Professional weavers of this province much prefer to add a simple fly-shuttle slay to their own slays to adopting the Salvation Army cottage loom. These are practically all the patent looms now on the market. It is exceedingly doubtful whether any of these looms is superior for all round qualities to the ordinary fly-shuttle loom. Mr. Chatterton's opinion may again be quoted:* "In connection with weaving in fly-shuttle looms the opinion has hitherto generally prevailed that fine cloths cannot be woven on looms fitted with the fly-shuttle attachment, because owing to the greater strain only comparatively coarse yarn which will not readily snap can be used for the warp. This opinion has abso-

(To be pasted on page 25 of the "Notes on the Industries of the United Provinces by A. C. CHATTERJEE, C.S.)

NOTE.

THE statement that the Salvation Army loom is useless for fine weaving needs correction. It has been ascertained that in the Hewett Weaving school at Bara Banki the following counts were being successfully used on the loom in August 1909, the warps being all locally prepared:—

Italian Silk: nos. 280-2, 210-2, 160-2, etc., in both warp and weft.

Wool: nos. 60-2, 40-2, 28-2, etc., in both warp and weft.

Cotton: nos. 60, 40, 33, 24 and 20 in warp of single thread: nos. 100, 80, 40, 33 and 24 in weft of single thread.

[illegible] great but variable degree of advantage in the use of the fly-shuttle. Roughly, it may be taken as three to

* Paper on the Salem Weaving Factory contributed to the Surat Industrial Conference, December 1907.

one. The looms which did the best all-round work in the competitions were those manufactured in Madras on the lines of the old English hand-loom . . . . . The European (or English) hand-loom, apart from the use of the fly-shuttle differs, from the country loom in the fact that it is self-contained in a frame and that the warp is beamed, and this process of beaming involves a considerable amount of extra labour preliminary to weaving . . . . . In the competitions a number of what were styled 'improved pit looms' were entered, which were in reality frame-looms, the longitudinal members of which were dispensed with by embedding the posts of the front and back frames very firmly in the ground. The system possesses the merit of cheapness, but the looms are in essential frame-looms. When allowance has been made for the labour expended in beaming, it is by no means definitely proved that the frame-looms can turn out more cloth than can be manufactured in the same time on country looms with fly-shuttle slays. The quality of the work is, however, better." I saw a large number of these improved pit looms at work in the factory of Mr. Theagoraya Chetti at Tondiarpet in Madras, and they seemed to me to be the best looms for adoption in a small factory or by an intelligent weaver.* From the short experience gained at the weaving schools started in these provinces last spring under the auspices of the Government, it has seemed to me that it will be comparatively easy to persuade individual weavers to adopt a fly-shuttle attachment for their own looms, but it will be extremely difficult to popularise the use of the frame-loom.† The dwellings of the weavers are at present adapted only to the narrow country loom, and in some cases to my knowledge weavers have had considerable difficulty even in setting up a fifty-four inches wide fly-shuttle slay. Although it is too early as yet to draw any inferences from the work of the schools in these provinces and as Mr. Chatterton has said it is unwise to predict, there seems every prospect of the fly-shuttle attachment to the country-loom catching on here. Mr. Theagoraya Chetti's improved pit-looms are superior to a mere fly-shuttle attachment because they have an automatic take-up motion and a warp beam. Neither of these factors affects the *real* speed of the loom to any great extent, although they make the cloth much more uniform in texture. So far the weavers of this province do not seem to appreciate the necessity of these particular

* For a full discussion of the comparative advantages of the pit-loom and the frame-loom see "*Report of the Proceedings of the Conference* held in connection with the *All India weaving competition* at Madras in March 1908."—(Srinivasa Varadachari, Madras.)

† Mr. Theagoraya Chetti said in his presidential speech at the Madras Weaving Conference: "I am satisfied that the pit-loom with the fly-shuttle arrangement attached, will become the ideal loom of the future and is bound to replace the ordinary country loom except of course in regard to the manufacture of solid bordered cloths."

improvements; but I hope in time it will be possible to convince them of their utility. The great advantages of the fly-shuttle slay are its simplicity and cheapness. They are being turned out by carpenters of this province at a cost of ten to twelve rupees, and it is hoped that ultimately local artisans will be able to manufacture the shuttles as well.

(3) Improvemer in preliminary p cesses.

40. In the last paragraph the various types of efficient looms have been discussed: many improvements are also feasible in the reeling, winding, warping and sizing processes that yarn has to undergo before it is brought to the loom. Thus in Bengal and some other parts of India hand-sizing is the practice. The weaver gives out the yarn to persons who specialise in sizing and finds it much more economical to devote his whole time to beaming and weaving. The rectangular warping frame is in universal use in the districts of Bengal where the fly-shuttle is in vogue. It is inexpensive and effects great economy of labour. In Madras, warping is done in a very efficient manner on two different types of handpower mill—one horizontal and the other vertical, and it is the practice of many weavers and also of the Salem Weaving Factory to give out the warping to the owners of these mills. Various new devices in warping and sizing have also been invented and experimented upon. The main principles will be found indicated in the report of the Weaving Conference at Madras in March 1908, the perusal of which will be useful to all interested in hand-weaving. The subject is highly technical and it is unnecessary to discuss it here in detail.

(4) A central ex perimental station.

41. As will be apparent from the remarks of Mr. Chatterton quoted above, no ideal loom or other appliances can be found to suit all kinds of weaving or different climatic considerations. It is impossible for a small local school to make elaborate investigations in the subject, nor can the owners of pioneer factories be expected to lay out much time or money over the solution of the different problems connected with hand-weaving and the preliminary processes. I therefore suggested last year the establishment in these provinces of an experimental weaving station and Government auspices. The suitability of the different styles of improved loom to the climatic [illegible] of the provinces, together with the modifications that will probably be found in them to meet local needs, can be determined in a conclusive and satisfactory manner only at such an institution. It should also be a part of the work of the [illegible] to ascertain which of the improvements in the preliminary processes [illegible] these provinces (1) by weavers working at home and (2) by small [illegible] hand-weaving factories. Another function of the [illegible] principles and practice of different branches of [illegible] wish to set up hand-loom factories in the [illegible]

station was approved by the Industrial Conference at Naini Tal, and it is hoped that an institution will soon be established. I find that at the weaving conference at Madras in March 1908 the Chairman, Mr. Theagoraya Chetti, a practical business man who has himself established a successful hand-weaving factory, strongly urged on the Government of Madras the establishment of a properly-equipped central factory with a full complement of experts on the lines suggested by me for these provinces. The Salem Weaving Factory is worked on a comparatively small scale, and there is no staff there either to teach or to carry on any elaborate experiments.

(5) Small demonstration schools.

42. The central factory suggested above will be mainly for experimental and research work. This factory would not, however, be sufficient to bring the new methods and appliances home to the weavers. They are an unusually conservative class, and it would hardly be possible to get weavers from all parts of the provinces to come and learn the processes at a central factory. Mr. Chatterton is of the opinion that the establishment of industrial schools for the teaching of weaving is not likely to do much good unless run on practical commercial lines, and the expenditure they would entail would be quite out of proportion to the results likely to be achieved. I venture, however, to think that the outlay incurred in establishing small schools at some of the larger weaving centres, *e.g.* Azamgarh, Tanda, Moradabad, Jaspur, etc., would be money well spent if the new processes can thereby be popularized among the weaving castes. A weaver working on his own would be able to utilize the cheaper appliances, while co-operative societies and small capitalists wishing to start hand-weaving factories would be benefited by the training of a number of artizans in the comparatively more expensive methods and appliances. These industrial schools would, moreover, be of very great value indirectly in raising the intellectual standard among weavers, regarding the necessity of which all are agreed. Some experience has already been gained in these provinces in this matter. The Hewett Weaving School was established at Bara Banki in the spring of 1907 through the energy of the Deputy Commissioner, Mr. C. A. Sherring, and the liberality of the local taluqdars headed by the Raja of Jahangirabad. Until recently only Salvation Army models of improved looms were taught and demonstrated at this school. Weavers came from all parts of the district and some from other districts in the provinces. They have all been convinced of the superiority of the new loom over the country loom for plain coarse weaving. The cost of the Salvation Army loom has so far stood in the way of an individual weaver buying a loom of this type with his own money, but several public-spirited landlords have presented looms to trained weavers belonging to their respective estates, while a

number of small factories has sprung up in the district some of which are being run on sound business lines. Since April 1908, three demonstration schools under Government auspices are working at Saharanpur, Moradabad and Tanda. At these schools fly-shuttle looms of the Madras type as well as the Serampur type (*viz.* fly-shuttle slay with a warping beam, but without a take-up motion, fixed on to the ordinary country loom) and the Salvation Army automatic loom are being taught and demonstrated. It is too early yet to judge, but there are indications that at all three places the schools are likely to exercise a considerable impression on the weavers. At the beginning we could get only "the waifs and strays of the weaving community" to come to the schools* in spite of the grant of a subsistence allowance. At the time of writing (September 1908) the applications for admission are more numerous than can be entertained, a better class of candidates is forthcoming and they all undertake to purchase a slay on the completion of their training, depositing a portion of the subsistence money towards that object. Several of the passed pupils have set up fly-shuttle attachments to their looms at home and others have obtained employment in small hand factories. The results so far are distinctly encouraging.

(6) Cheap credit

43. There is next the question of securing cheap credit for the weavers. The Benares Silk Weavers' Association has already been remarkably successful in this direction, as will be evident from a perusal of Mr. Hope-Simpson's manuscript note of the 9th February 1907. Cotton weavers in other districts (*e.g.* Moradabad, Unao and Bulandshahr) have displayed readiness in joining the local co-operative banks. At present almost everywhere cotton-weavers are to a great extent dependent on mahajans or middlemen. In most centres of the industry the yarn dealer is different from the mahajan or dealer who takes over the manufactured cloth at a price or on commission sale. Both these dealers perform a useful economic function under present conditions, and their profits are not as high as is often imagined. I have made special inquiries on the subject and always found that there was considerable competition amongst the dealers themselves and in view of the risks involved, they earn only a reasonable rate of interest on their capital. At the same time in the very unequal struggle between the hand industry and the power-loom industry, the former if it intends to maintain its present ground or win back some lost ground must adopt all possible economic expedients, and cheaper credit by means of co-operation is one of them. The adoption of efficient looms with their large output moreover compels the weaver to invest a larger

* Mr. Chatterton has had a similar experience at the Salem Weaving Factory. See his paper read at the Surat Industrial Conference, December 1907.

sum of money in yarn, and if superior classes of goods are woven the capital will remain locked up for a longer period than at present. At the Moradabad school we are teaching the weavers to manufacture striped cloth of pleasing patterns for which there is a great sale in the winter months. Goods manufactured early in the summer will, however, have to be kept nearly six months before disposal. In these ways a weaver using an improved loom will require a larger amount of credit than he does at present. Unless, therefore, he is placed in a position to buy raw materials and sell finished products on better terms than now, the adoption of new methods and appliances will not very materially augment his earnings. The Government have already recognised the necessity of the development of co-operation among the industrial classes and the present Registrar (Mr. Fremantle) is taking steps to start a pioneer society amongst the weavers of Tanda.

(7) Advances for improved appliances.

44. Another way of financing the weaver would be to grant him advances for the purchase of improved appliances, in the same manner as advances are given to cultivators for agricultural improvements. Instead of giving out money, looms and other appliances might be given on condition of easy payment of price. I think the latter method would be attended with fewer difficulties, especially as many Julaha weavers have a religious prejudice against the paying as well as receiving of interest. They would not, however, I fancy, object to have the interest included in the price in the instalment system. The agency of reliable co-operative unions should be utilized wherever possible for the grant of such advances. It could also be worked in conjunction with weaving schools. It will not thus be necessary to impose additional work on the revenue staff of a tahsil. The system of giving advances to the passed pupils of the weaving schools for the purchase of looms has now been deemed essential by the Government for the success of the scheme of the schools, and a sum of money has recently been placed at the disposal of the school committees for this purpose. A few advances have already been granted and local authorities apprehend no difficulty about getting back the money.

(8) Better touch with customers.

45. The weaver also requires to be placed in touch with his customer. Is is true there is not very much change in the fashions of the coarser stuffs for which a local market is usually available and sufficient, but the reverse is the case with the finer fabrics. It is impossible for a weaver in Tanda to gauge the changing requirements of his customers in Nepal, Hyderabad, Bombay or Calcutta. During the last three or four years there has been a very great demand for hand-made cloth in Bengal. The weavers in this province with a few exceptions are not aware of this fact and do not.

know exactly what style of cloths is wanted. In pattern weaving specially, new designs are constantly asked for by customers. It should be one of the functions of the weaving schools and of the provincial bureau of industry to furnish this link between the customer and the producer wherever necessary. To give one instance, the upper and lower middle classes among Indians go in extensively for cotton checks of various kinds. Very little of it is manufactured in the province; imports come either from Europe or from the Punjab and other provinces of India. Cotton checks are woven most extensively in Ludhiana and other districts of the Punjab. Very fine yarn is not required for this class of goods, and the great variety of designs is a factor in favour of hand-loom weavers. An attempt is being made through the weaving schools at Moradabad and Saharanpur to introduce the manufacture of this style of fabrics at these places and our efforts in this direction have already been appreciated by local weavers. Similarly at Tanda the weavers are being encouraged to weave *dhotis* of fine counts for which there is nowadays a ready sale throughout the provinces. The consumption of the cheaper kinds of German shawls has also been increasing very much in recent years, especially in the eastern districts, where they are displacing the more cumbrous blanket or woollen quilt for outdoor wear. I believe these shawls are made almost entirely of cotton or perhaps cotton and jute. An effort should be made to manufacture them locally. They cannot be much more difficult to weave than the cotton and wool *dhusas* of Gorakhpur to which reference will be made in the chapter on the woollen industry.

(9) Small factories.

46. In respect especially of gauging the needs of customers the small weaving factories under private capitalists, so strongly recommended by Mr. Chatterton and also advocated by the non-official Industrial Conferences of this province, are likely to have a very great pull over individual weavers. If they are managed by commercially trained men fully versed in the art of business-pushing, they would soon ascertain the different requirements of the various markets in India, and will thus be able to set an example to a weaver working at his own home. Such factories will also have the advantage of effecting purchases and sales at wholesale rates. The more expensive methods and processes of hand-weaving could only be adopted by small factories.* As a very large capital is not required for the establishment of this class of factories, they ought to afford an opening for the middle classes, who are now realizing that Government service and the learned professions cannot provide room for all of them. The successful management of such factories will also be a good training for larger

* If improved warping and sizing methods be beyond the means of the cottage weaver, these factories will with profit to themselves perform the useful function of supplying the latter with ready-made sized warps and cops for wefts.

ventures in the way of power mills. These factories will not be anything absolutely new, for the system of a prosperous weaver employing a large number of hands in his own establishment is quite familiar to the country. What is wanted is that men with some education and business ability should also embark on the enterprise and adopt up-to-date industrial and commercial methods. The idea of hand-weaving factories has caught on in Madras, and it would not reflect to the credit of these provinces if sufficient enterprise is not forthcoming to establish a few factories here. In some quarters a fear has been entertained that the development of the factory system will stifle all the artistic instincts of the cottage weaver, and lead to the moral and mental degradation of the artisan. From what I have seen of the working of private factories in the Madras presidency I am of the opinion that these apprehensions are entirely groundless. The weaver is as much the artistic master of the loom at the factory as at his own home. As a matter of fact these so-called hand-loom factories with a hundred to two hundred looms bear no resemblance whatever to power factories. Moreover for the development of the factory system it is not essential that all the looms should be congregated in a shed or sheds in the same enclosure. It should be quite feasible to leave the looms at the homes of the weavers, the supervision and the financial responsibility resting with the owner of the business. The success of a hand-loom factory will depend to a very great extent on the technical knowledge and business capacity of the owner. Moreover, it will be hopeless to expect a very small factory to pay all the expenses of a staff and supervision. Mr. Theagoraya Chetti, who has invaluable practical experience in the matter, stated at the weaving conference at Madras that a factory was not likely to be successful unless it had at least a hundred looms. The few factories so far started in this province have not done as well as they should have on account either of their very small size or the want of thorough technical knowledge on the part of the proprietors. The small factory that is being worked under the supervision of M. Ramgarib, the energetic Secretary of the Kayasth Bank at Gorakhpur, has the promise of success. The factory of Mr. Puran Chandra at Landhaura in the district of Saharanpur is located away from the ordinary weaving centres, which may prove to be a disadvantage, both for supply of labour and for marketing.

Hosiery.

47. Knitting is an industry closely allied to weaving. The middle classes of the urban population have taken extensively to the use of cotton hosiery. Even the servants of the upper classes nowadays wear cotton socks. Cotton undervests are also worn a great deal. Socks and undervests form an important portion of the stock in the shops all of drapers in the bazars of the province. They are almost all imported;

mostly from Japan. It is not possible to give figures of import or consumption for the province as hosiery is included within the general head of apparel in the traffic returns. Some very striking statistics will, however, be found in the article on the Indian hosiery trade published in the *Indian Trade Journal* of August 20th, 1908. The export of hosiery from Japan to British India rose from £116,400 in 1905 to £276,800 in 1907. This is all the more remarkable when it is remembered that Japan imports the raw cotton from India and has to pay double freight, the Indian import duty and other incidental charges. The conditions of the Japanese industry are also very interesting. "In 1906, there were in Osaka (the chief seat of the industry), 148 factories or houses where hosiery work was carried on. Of these only 7 employed more than 50 hands, while in 117 houses the manufacturing was done by less than 10 workers. The work is almost entirely done *by hand*. The number of employés is just over 1,100, *mostly females*. The daily wages (for a working day of 12 hours) are approximately 12½ annas for men and 6½ annas for women . . . . The machinery (at one of the principal factories) with the exception of the machines for making the borders of the sleeves and the sewing machines, was all of Japanese make.. The original patterns were American, but the copies had been successfully made at about a quarter of the price." The account of the Japanese industry strengthens very much the suggestion made in the preliminary edition of these notes that the manufacture of cotton socks and undervests should be started as a hand industry in the province. It will provide employment for *parda* women who now earn a precarious livelihood by hand spinning and embroidery work. If the factory is a small one employing not more than twenty hands, it may be possible to bring into the same house the women from the *muhalla*. Moreover it will probably be found feasible to give out the knitting machines to women working at their own homes for a piece wage. Only coarse yarn is required for cheap cotton hosiery and the spinning mills of the province should be able to utilise local cotton for the purpose. The rate of wages for skilled labour in the province is not higher than what is paid to the workers in Japan. There is no reason why local enterprise should not succeed in supplying the requirements of the province. I would, however, strongly deprecate the starting of hosiery factories (except as adjuncts to weaving factories) with only two or three machines. Such a concern will not pay the expenses of supervision, unless the owner himself works a machine. A few small factories have been started in various towns of the province. So far as I have been able to ascertain they are paying their way, but more enterprise is needed in order to make the business profitable. At the Hewett Weaving School in Bara

Banki, learners who buy a knitting machine beforehand are taught its use by a qualified instructor. Several pupils have thus been trained and I hear they are all getting on well. I would suggest the teaching of the use of the knitting and sewing machines (in addition to ordinary knitting and sewing) at all girls' schools in the province. Efforts should also be made to manufacture knitting machines in the country, like the Japanese have done. The initial cost of a machine at present stands in the way of its use by the classes who are likely to profit most by it. As regards the manufacture of finer grades of hosiery in power mills, I am unable to offer any definite opinion. The Petit weaving mills in Bombay and the Bangalore mills turn out very fair cotton socks which I have seen for sale in drapers' shops in the province. A hosiery mill on a fairly large scale is also being started in Calcutta with Indian capital. The success of these ventures may be awaited before power mills are started in this province.

tton Ropes and

48. I have made inquiries about the manufacture of cotton ropes in the province. The Cawnpore mills make a certain quantity for their own use and in connection with the manufacture of tents. Cotton ropes from Muttra are to be found in many of the local bazars. There are three or four factories at Muttra, and rope-making is a fairly flourishing industry there. Cotton ropes are also manufactured to a small extent at Farrukhabad, Agra, Bareilly and Meerut. The processes are very rough and primitive, exceedingly simple implements being used. The employment of some improved means of imparting a properly regulated twist to the strings forming the rope (something similar to the mule or ring of the cotton spinning mill) will probably suggest itself to a mechanical engineer. The manufactured rope is sold to local dealers who export to other towns in small quantities. There is a fair demand in the province for cotton ropes for pankhas, tents, hangings and curtains, etc., and I think the industry is likely to be remunerative in the hands of a small capitalist capable of organising and advertising his business. There is no reason to localise the industry at Muttra and a factory could perhaps be started anywhere. Good cotton tapes and *newar* are manufactured in the Farrukhabad district. Some *newar* weaving is carried on in every district. The method of weaving is very simple and the craft is not confined to any particular caste. In Meerut at one time a very large number of Julahas used to earn their livelihood by *newar* weaving. The Ordnance and Military Stores departments used to purchase their requirements mostly from Meerut contractors. The business has dwindled; but even now about a hundred weavers in Meerut weave *newar*. The dealers supply yarn spun at the Delhi mills

(usually no. 8) to the Julaha and pay him by weight according to the width and quality of the tape. These dealers supply local needs and also sell to the contractors of the arsenals. I have not been able to think of any suggestions for the improvement of this industry, except the offer of a reward for the invention of a simple loom which will weave simultaneously several strips of tape of a good texture.

Cotton carpets.

49. The cotton *dari*-weaving industry is fairly vigorous in this province. Three sizes, *viz.* for (1) floors, (2) bedsteads, and (3) prayer carpets, are usually made. A clear and well-illustrated account of the processes and the raw materials employed is given in Kunwar Jagdish Prasad's monograph on Carpet Making in the United Provinces. Some very good illustrations will also be found in Captain Twigg's monograph on Carpet Making in the Bombay Presidency. The industry is localised in these provinces at Agra, Bareilly, Aligarh and Cawnpore. A fair number of looms are also in use in Moradabad, Meerut, Farrukhabad, Etawah and Benares.

In Agra, the number of looms is estimated to be 500, and more than a thousand persons are engaged in the industry. Large dealers in *daris*, of whom there are about twenty, give advances to the owners of the looms, usually in money and only occasionally in yarn. The loom-owner buys the yarn locally, and employs other weavers to assist him, generally on pieee-wages. A journeyman weaver earns about three annas a day. It is difficult to estimate the earnings of the master-weaver. Most men weave small bed *daris*. Only a small proportion weave floor carpets. The yarn used is as a rule from the local spinning mills. Indigo is employed for dyeing black or blue. Red yarn is either purchased ready dyed or is dyed at home most ineffectively with aniline colours. The Agra *daris* have a wide reputation all over the province, and so far as I could ascertain there has been no decline in its popularity. The money wages of the weavers (who are all Musalmans, though not all Julahas) is very low and the greater portion of the profits seems to be annexed by the dealers. Bed carpets mostly are manufactured in Aligarh, of a coarser but more compact style than the Agra carpets. The number of looms is estimated to be three hundred. The weavers are all Musalmans and work on the same system as at Agra. Handspun yarn is used to a large extent. It is often spun out of spent cotton. In Etawah there are about fifty looms, with a hundred workmen, all castes of Musalmans being represented excepting Julahas. There is a sort of guild of the workmen which levies an admission fee of Re. 1-4-0 from the son of a member, Rs. 2-8-0 from a new man and Rs. 6-10-0 from a new man who sets up a factory of his own. Mill yarn is mostly used. The dealers give no advances to the

workmen who have to obtain credit from ordinary money-lenders for the purchase of yarn and the advance of wages to the journeymen workers. Black and blue colours are dyed with indigo by a *rangrez*. The other colours are obtained with chemical dyes by the weaver himself. The *daris* sell at about a rupee a *ser*. In Bareilly, there are about two hundred master workmen who employ three to ten men each. The number of weavers is roughly one thousand—all Musalmans, but not necessarily Julahas. The wages are about a rupee for the weaving of four square yards. Nothing is paid for the day spent in preparing the warp. The average earning of a weaver is about four annas a day. The master workman takes an advance in money from the dealer and either makes according to the latter's order or sells to him whatever is turned out. The warp is of hand-spun yarn from new cotton. The weft is usually hand-spun yarn from spent cotton. Such *daris* sell at ten annas to fourteen annas a square yard. Better qualities utilising mill yarn are also manufactured, but in small quantities. The machine yarn usually comes from Cawnpore. The yarn is as a rule purchased by the master workman himself in the daily markets in Bareilly and adjoining villages. Only occasionally the yarn is advanced by the dealer. The blue and black colours are obtained with vegetable indigo. For the other tints, aniline dyes are employed. A *rangrez* or professional dyer is kept in permanent employ at the larger factories. In the smaller establishments, ordinary workmen do all the dyeing. About half the *daris* made are of the bed size. Seven dealers (of whom two are Musalmans) monopolise the trade and export to other districts. The business is steadily increasing. The *daris* manufactured in the city of Meerut, mostly for contractors to the Army departments, are of very inferior quality. There are about one hundred and fifty weavers, all Musalmans. Only hand-spun cotton is used, the weft being almost always of spent cotton. Aniline dyes are exclusively used, even for black and blue, the weavers themselves doing the dyeing. The texture is very thin. The price of these *daris* ranges from eight annas a square yard. I was told the demand was increasing. Similar conditions prevail in most other centres of the industry. *Daris* are as a rule woven in towns, but in the district of Meerut a good deal of the industry is carried on in the villages of Sardhana and Baghpat tahsils. At Cawnpore, the *dari* industry has been to a great extent organised by the large cotton mills and tent manufacturers. The actual weaving is done on hand looms by weavers with no better training than those in other towns. The mills supply yarn (generally of their own manufacture) and dyes to a contractor who sets up looms inside the mill enclosures and employs the actual weavers. Synthetic dyes are utilised

but with good results owing to skilled manipulation and the use of proper apparatus and power. The superiority of the Cawnpore *daris* over the bazar article is due to better dyeing and careful supervision on the part of the mill authorities. Otherwise the system of advances prevails and the condition of the weaver himself is not very satisfactory.*

I am not aware of any experiments having been made in this country with an improved or fly-shuttle loom in *dari* weaving. With certain alterations an improved loom may possibly be used for weaving carpets of the bed size. The attention of inventors may be drawn to this matter. Much benefit will also result to the industry if better methods of utilising the aniline dyes can be introduced. Small factories might be established in the principal centres of the industry under competent dyers in order to supply properly dyed yarn to the weavers. These factories could work with chemical as well as vegetable dyes, and would not require a large capital, as the yarn would be supplied by the weaver himself. I venture to think such factories will prove very profitable besides being of great service to the *dari* industry. The chief obstacle to the development of the present industry is the impoverished condition of the master as well as journeyman weaver. Under the system of advances they are bound hand and foot to the middleman dealer, who again has not sufficient enlightenment and enterprise to adopt modern methods of advertisement and business organisation. The cost of the raw materials in the case of *daris* is not very large. There is considerable communal feeling amongst the *dari* weavers, especially in Agra. Both loom-owners and journeymen weavers there expressed to me a desire for easier credit. Co-operation ought to prove as successful amongst the *dari* weavers of Agra as it has done amongst the silk weavers of Benares.

Cotton *daris* or *satranjis* are now charged second class rates by the railways. Considering their value compared with cotton piece-goods and woollen carpets, the present rates appear to be excessive and I have separately advocated the removal of cotton carpets to the first class tariff rates.

I have been informed on good authority that a market could be found in Europe for tapestry *daris* (but not for plain or striped *daris*). If the industry were in the hands of enterprising merchants, this market could be cultivated and developed.

Complaints have also been made to me by *dari* dealers of the competition of the jail industry. It is alleged that jail *daris*, although rich in patterns and good in

* In page 83 of his Monograph on Carpet Making in the Bombay Presidency, Captain Twigg speaks of the Agra and Cawnpore *daris* as being "able with steam-driven machinery to completely oust every locally-produced *dari* of simple striped design." The reference to steam power must have been made under a misapprehension.

quality, are sold cheaper than they could be manufactured with free labour. I have not myself seen many jail *daris* in the bazars, and was under the impression that latterly manufacture was confined to orders from Government departments. The matter perhaps deserves further departmental inquiry.

Tents.

50. The tents manufactured in these provinces are mostly of mill-made cloth. At one time a considerable quantity of hand-made cloth was used, but this is no longer the case. The industry is carried on in an organised manner by the cotton mills of Cawnpore and some smaller European firms in that city. The subsidiary industry of *dari* manufacture at Cawnpore has already been referred to. There is a large tent factory belonging to an Indian firm at Agra which gets orders from the Army departments. Smaller factories are to be found in Meerut, Bareilly and other towns. Fatehgarh tents have a considerable reputation. There are about eight factories in Fatehgarh owned by Hindus as well as Musalmans. The cloth is either purchased locally or imported from Calcutta or Cawnpore. It is then given out to the Sadhs (the calico-printing community of the adjoining town of Farrukhabad) to be bleached, dyed and printed. After these operations have been completed, *darzis* are employed on monthly wages to make up the cloth. The leather is bought locally or at Cawnpore and Calcutta and local *mochis* work up the leather fittings. The wooden posts are imported by the river (Ganges) and bamboos come also by river from the Eastern districts or from Hardwar. The *tats* (for sacking and matting verandahs) are hand-made and obtained from the South Oudh districts through the Cawnpore market. Cotton ropes and tape as also cotton floor carpets are purchased from local manufacturers. The tents of Fatehgarh find a sale mostly in the native states of Rajputana and Central India. The only lines of improvement that can be suggested are better organisation and more extensive advertisement as well as prompt execution of orders.

Chapter II.—The Silk Industry.

Sericulture in the provinces.

51. The various attempts to introduce sericulture into these provinces are described by Mr. Yusuf Ali in his Monograph on silk fabrics. At the time he wrote (1899) experiments were in progress at Chakrata, Dehra Dun and Partabgarh for the cultivation of silk. In Chakrata the Forest department tried to acclimatize the Chinese tasar worm. This experiment did not prove a success and was abandoned after two years. The insect thrived best upon the leaves of the Karshu oak *(Quercus semicarpifolia)* at an elevation of 8,500 to 10,000 feet above sea-level. In Dehra Dun the lands of the Lister Grant, where sericulture was tried, have since been sold to an Indian gentleman and no cocoons are reared now. In Partabgarh Raja Rampal Singh of Kalakankar still continues to rear eri and mulberry silk worms. He introduces new seed at least once a year, but also uses some homegrown seed. The silk is reeled on the estate and whatever is left over after the personal needs of the Raja are satisfied is sold through Messrs. Moran & Co. in Calcutta. The Raja has informed me that he has obtained up to sixteen rupees per seer for his mulberry reeled silk. He thinks his tenants are now beginning to take an interest in sericulture. In the Raja's opinion an extension of the business will be profitable both to himself and his tenants.

Collection of wild tasar.

52. In the hilly tracts in South Mirzapur, cocoons of the wild tasar are collected by the aboriginal Kols.* Two crops are obtained, in September and November. In a normal year, the number of cocoons collected has been calculated to be about four millions. There is a great falling off in seasons of drought and scarcity. In some cases the collector himself reels the cocoons, but the greater portion are brought in to Ahraura (in the Mirzapur district), where a colony of *Nanakpanthi patwas* is settled. There are about forty families of this caste who purchase the cocoons, reel them and manufacture two varieties of tasar locally known as *dungri* and *chhena*. Sometimes traders from Bengal, especially from Bhagalpur which is the centre of the *bafta* silk industry, purchase the raw cocoons at a price of five to six rupees per thousand, but the quantity of raw cocoons exported in this manner is small. The locally reeled *dungri* is exported to the Central Provinces † (Nagpur, Bhandara, Bilaspur, &c.), and fetches a price between fourteen and sixteen rupees per ser. The

* See Mr. Yusuf Ali's Monograph on silk fabrics, paragraphs 95 to 106, 125 to 129 and 619 to 623.

† In 1905-06, 262 maunds of Indian raw silk were exported from the Benares block to the Central Provinces.

inferior variety *(chhena)* is purchased mostly by the weavers of silk and cotton unions of Benares, Azamgarh, Bhagalpur, Patna, Gaya etc. In a normal year *chhena* silk sells at Ahraura at four to seven rupees per ser. Mr. Yusuf Ali suggested the extension of the industry to the Karwi sub-division of the Banda district where the country resembles south Mirzapur. No efforts have, however, been made in this direction. Considering the consumption of silk cloths of various kinds in the province it seems a pity that the best portion of home-grown silk should be exported. Ahraura is within easy distance of Benares and Azamgarh, the two centres of the silk cloth industry in the province. The organisation and development of the Ahraura industry and the utilisation within the province of the raw silk turned out there are matters deserving the attention of local capitalists.

Traffic - Returns of Raw Silk.

53. The traffic returns concerning the import and export of raw silk do not give any satisfactory results. On account of its price a large proportion of the consignments of silk is carried by passenger train or by post, and as the total weight is comparatively small, errors easily creep in. For instance, in 1905-06 Rohilkhand exported sixty-four maunds of Indian raw silk to the Punjab and none whatever in the previous year. No silk is reared in Rohilkhand and there is no large silk depôt there either. Again, the total imports in 1905-06 of foreign raw silk into the province are shown as nine maunds,—all to the Agra block,—whereas all the silk for Benares Cossi silk comes from foreign countries through Bombay port.

Population Statistics.

54. The population statistics for the silk industry according to the 1901 census are given below :—

Silk carders, spinners, weavers, braid and thread makers.

I.—Actual workers—		
(1) Only silk—		
Males		3,822
Females		2,419
(2) Partially agriculturists—		
Males		51
Females		4
II.—Dependants, both sexes		6,416
Total ...		12,657
1891 *Census.*		
Provincial—		
Males		8,083
Females		6,853
Total ...		14,936 (urban 14,712)

Benares accounted for 12,871.

Centres of Silk Industry: Agra, Jhansi a Farrukhabad.

55. The chief centres of the silk industry in the provinces are Benares and Azamgarh. Some silk weaving is also carried on in the towns of Agra, Jhansi and Farrukhabad. At Agra, there are only eight or ten Julaha families in muhallas Shahganj and Nai-ki-Mandi who still practice silk weaving. The yarn is purchased locally, and the fabrics known as *susi*, *ilaicha*, *daryai* and *doria* are usually woven. Aniline dyes are used. The outturn is not of high merit and is sold in the local market. There is very little enterprise amongst the Agra silk weavers. In some cases I found that dealers came down from Amritsar with yarn and dyes and employed Agra weavers on piece-wages. The cloth is taken back to Amritsar and I fancy is ultimately passed off as Amritsar silk. Unlike Benares, there is not in Agra any silk weaving with gold or silver *kalabatun*. Considering the favourable situation of Agra (at the junction of many railways and close to the native states of Rajputana and Central India) and the great influx of visitors during the cold weather, there should be no lack of demand if really good silk stuffs were manufactured locally. The success and prosperity of the Agra embroidery firms should stimulate the capitalists of the town to establish small silk weaving factories. Labour if properly remunerated would be forthcoming locally and could also be recruited from Farrukhabad, Jhansi and Benares. There should be no difficulty whatever in effecting improvements in designs. Economy in the process of weaving will also probably be found feasible, as has been amply demonstrated by the enterprising proprietors of the Minakshi silk cloth factory at Madura in South India. A small matter of detail connected with silk weaving in Agra is the levy of octroi duty on silk yarn. The weavers complain that even the yarn imported from Amritsar mentioned above has to pay the municipal duty. In view of the depressed condition of the industry in Agra, I think the duty on silk yarn may well be remitted. In Jhansi and Farrukhabad the use of silk yarn is now almost confined to the manufacture of cotton cloths (especially *saris* and *lehngas* for women) with silk borders. Imported silk is utilised, the weaver buying it from the local dealer who gets his requirements from Cawnpore or Bombay. The borders are very pretty and artistic and this class of goods is likely to have a decent sale in the larger towns if properly advertised or exhibited in the drapers' shops. In these two towns I came across some samples of cloth with a cotton warp and silk weft similar to the muslins of Mau in the Azamgarh district. There is no special class of silk weavers either at Jhansi or at Farrukhabad.

(2) Azamgarh.

56. In Azamgarh, cotton and silk union is the speciality of Mubarakpur although some Azamgarh satin is manufactured in Mau, Kopa and one or two other places.

The fabrics usually woven are *sangis* and *ghaltas*. They will be found described in Mr. Yusuf Ali's monograph on silk fabrics (pages 89 and 91). The warp is usually cotton and the weft is silk or *vice versâ*. The raw material used is both mulberry and tasar silk imported mainly from Bengal. Cloth of various textures, checks, stripes and plain is manufactured. The work is fine and artistic. The *ghaltas* are as a rule woven with white yarn and then dyed by the dealer. Chemical dyes are used. The dyers mostly live in Azamgarh and are paid piece wages. As in other centres of silk manufacture, complaints are rife about the unsatisfactory character of the dyeing processes now in vogue. The dyeing of silk yarn should receive early attention from any dyeing experts that may be employed by Government. In the district of Azamgarh, the weaver as a rule buys his own yarn and sells the finished product (sometimes undyed) to the dealer. The mahajan and the dealer are not always the same. The price of cotton as well as of silk yarn* has risen very much in recent years. Owing to unfavourable agricultural seasons the demand for Azamgarh satin has contracted and the prices even outside the province have not kept pace with the rise in the price of the raw materials. Plague has been severe in the Azamgarh district during the last few years and a large number of artisans has succumbed to the disease. All these causes have contributed to a depression in the satin industry, and I was told that some silk weavers had descended to the weaving of *dakhini* cotton *pagris*. The remedies that suggest themselves are :—

(1) Co-operation in the purchase of yarn. The silk weavers of Azamgarh are not quite so destitute as the average cotton weavers of the province, consequently the difficulties in the way of co-operation will not probably be very great.

(2) Outside the province, a market for Azamgarh satin is found in Calcutta, Nepal and Hyderabad. If up to date commercial methods are adopted, the provincial market can be developed and new openings will probably be discovered in the Punjab, Sindh, the Musalman States of Rajputana, Central India, etc. The use of pure silk being forbidden to the orthodox Musalman, a stuff like Azamgarh satin should have a wide popularity in that community. Azamgarh (specially Mubarakpur) is not a very accessible place and the dealers are old-fashioned in their methods.† The employment of modern business pushing devices is absolutely necessary.

* See Review of the Trade of India in 1906-07, page 52.

† A realistic description of the old-fashioned merchant will be found in Mr. Yusuf Ali's "Life and Labour in India" page 11.

(3) The establishment of small factories by enterprising and educated men. The adoption of improved looms will probably be found practicable. A small capitalist will be able to purchase yarn and sell his outturn on more advantageous terms than the cottage weaver. He should also succeed in introducing new designs and should get into better touch with the consumer.

(4) Improvement in dyeing methods.

57. The different branches of the Benares silk industry may be thus classified :— **(3) Benares.**

(1) *Tarkashes* or wiremakers and gilders.

(2) Silver and gold thread or *kalabatun* makers ; these two classes will be treated in detail below.

(3) Dyers—the dyeing is in some cases done by the Julaha weaver himself, but as a rule by a special class known as Laheras. I have nothing to add to the description of the processes given in chapter IV of Mr. Yusuf Ali's Monograph. As silk fabrics wear longer than cotton or woollen stuffs and partake more of the nature of art products, the question of dyeing is comparatively more important. There is frequent complaint now about the quality of the Benares silk colours. Only imported dyes are employed, but the dyers and the weavers have not yet mastered the art of the use of foreign dyes.

(4) *Designers.*—Old designs are mostly used. The design is first drawn on talc or paper, then the designer makes out a model of it in cotton thread on small frames. This art is known to only six or seven families in Benares, who have a natural antipathy to any increase in their numbers. (I understand one man recently learnt the process at Bombay and Ahmedabad.) Consequently very large sums have to be paid to the designer if it is desired to introduce any new or original design and transfer it from paper to the yarn frame. In Surat and Ahmedabad also the number of brocade designers is very limited.

(5) *Weavers.*—Of these there are now three classes, *viz.* :—

(*a*) *Sari* and *dupatta* makers.—The work is simpler than in the case of *kamkhwab, pot, amru, mashru,* &c. The largest business is, however, done in this class of garments as there is a great sale among the well-to-do pilgrims to Benares. Silk *saris* and *dupattas* are also preferred for all ceremonial occasions by orthodox Hindus.

(*b*) Brocade weavers.—The various kinds are fully described by Mr. Yusuf Ali in his monograph.

(*c*) Plain Kashi silk weavers.

(6) *Embroiderers.*—The number of this class is comparatively small. They are employed by fairly well-to-do firms to embroider with *kalabatun* and *salma sitara*, etc., various fabrics such as caps, shawls, scarves, horse and elephant trappings, etc.

The raw silk for the first two classes or real Benares silk fabrics is imported almost entirely from the Murshidabad, Maldah and Rajshahi districts in Bengal. A very small proportion of China silk imported through Bombay is sometimes used. The loom is a highly specialized one, and the processes of warping and weaving, including pattern-making, have been clearly explained by Mr. Yusuf Ali.

Plain Kashi Silk.

58. Plain Kashi silk is a stuff the weaving of which was introduced into Benares about ten years ago. It washes well, is durable and can be made of various textures and is easily woven into checks and stripes. These qualities as well as the cheapness have contributed to its great popularity. The yarn is supplied to the Benares weavers almost entirely by an Italian firm in Bombay. It is imported from Italy where there are ten mills manufacturing the yarn. The "Società per la Filatura dei cascami di Seta" of Milan has practically a monopoly of the trade in Italy. The Societè Anonyme of Lyons and the "Industrie Gesellschaft fur Schappe" at Basle also spin this yarn. The materials from which the spun yarn is made are the usual kinds of waste and refuse resulting from the several processes connected with the reeling and throwing and manufacture of silk as well as from damaged cocoons.* Figures obtained from Italy show that 433 quintali or about 43 tons of this yarn were exported from Italy to this country in 1907. The mills mentioned above have a fairly large capacity and there is no immediate danger of a contraction or stoppage of supply. More than a million pounds in weight of waste silk are exported from India every year and there is also a considerable exportation of cocoons.† The question whether Indian waste silk can be utilised for the spinning of "Schappe" (as Kashi silk yarn is called on the Continent) is worthy of investigation by the silk factories of Bengal and also by persons interested in the Kashi silk weaving industry of Benares. Messrs. Parker, Sumner & Co., a British firm of Milan, will be prepared to supply estimates, information and

* For a description of the processes of spinning Schappe or chappe silk see *Zipser's Textile Raw Materials*—pages 454 *et seq.* (Scott, Greenwood).

† Review of the Trade of India in 1906-07, page 52.

expert advice should there be any intention of starting the industry in India. It may also be of interest to Kashi silk weavers in this country to know that fairly good qualities of chappe or spun silk are manufactured in England. Information regarding them can be obtained from the Silk Association of Great Britain and Ireland, Leek.

Organisation of the Benares industry.

59. The silk weavers of Benares are all Julahas. They do not weave cotton cloth, and may be divided into three different classes :—

(1) those who work for wholesale and retail dealers, the dealers being not themselves of the weaving class;

(2) those who work for the bazar and sell their own goods;

(3) those who work for Muhammadan *karkhanedars* or factory owners who are themselves richer members of the weaver class.

The brocade workers are almost all in the third class, while the other two classes represent the *sari* and *dupatta* makers and the Kashi silk weavers. The yarn is in almost all cases sold by a dealer and not imported directly by the *karkhanedar*. The same system now holds good for gold threads also. The first class of artizans are almost entirely within the power of the middleman dealer, who advances the yarn and takes the manufactured product either as a purchase or on commission sale. It was for the benefit of this class mainly that the Benares Silk Weavers' Co-operative Association was started, and the results have so far been eminently successful.

Traffic in silk piece-goods.

60. The traffic returns for silk piece-goods are not reliable for reasons mentioned above for raw silk returns. Another misleading circumstance is that cotton and silk mixed piece-goods, as also silk piece-goods mixed or worked with metal are classed under the general head "all other articles of merchandise." Similarly silk scarves and turbans are classed under "apparel." Thus practically all the manufactures of Benares and Azamgarh are excluded from the head "silk piece-goods" in the traffic returns. We can, however, form some idea of the import trade from the returns. In 1904-05 498 maunds of *foreign* silk goods came from Bombay seaport, almost entirely to the Allahabad division. Out of it 278 maunds were exported mainly through Agra to Rajputana. In 1905-06 244 maunds were imported and only 13 exported. In 1906-07, the imports fell to 176 maunds and the exports rose to 61 maunds. Of Indian silk piece-goods 1,403 maunds were imported in 1904-05, and 163 maunds were exported. In 1905-06 982 maunds were imported and 18 exported. The figures for 1906-07 are 1,057 and 35 maunds respectively. The imports come mostly from Bengal and Bombay. Benares at one time used to be the great distributing centre in this province for imported silk goods, but Cawnpore is now fast taking the premier place in

this respect. The stuffs imported from Bengal are mostly Murshidabad silks, the tasar garments of Western Bengal, and the mixed products known as *bafta*, &c., of Bhagalpur. From Bombay the piece-goods imported are, I believe, mostly the products of the Sassoon mills.

Suggested developments.

61. Considering that the silk industry of this province has to depend almost entirely on imported raw materials, I am afraid that there is not much chance of any wide or rapid development. It is difficult to make any estimate of the value of the products turned out by the looms in Azamgarh and Benares. The general impression is that the volume of the business has not declined in recent years. The suggestions for the improvement of the cotton-weaving industry apply with necessary modifications to the silk industry and do not require repetition. As regards raw materials, I would again draw the attention of the enterprising residents of Mirzapur, Benares and Allahabad to the tasar silk of South Mirzapur. It now finds its way to distant Sambalpur in Orissa and Bilaspur in the Central Provinces. With careful supervision and requisite technical knowledge it could probably be utilised for the weaving of fabrics of rough silk or silk and fibre unions which are now so fashionable for hot weather use and of which an increasing quantity is imported every year from Bengal and abroad. Mention has also been made above of the feasibility of spinning "sehappe" or Kashi silk yarn in this country if not in this province. The subsidiary industry of gold thread manufacture is discussed below. The question of dyeing has been briefly referred to above and will also be separately considered later on. I am inclined to attach very great importance to expert investigations in the methods of bleaching and dyeing silk and to teaching the dyer the proper use of both vegetable and synthetic dyes and mordants. Good and fresh designs are an important element towards the continued prosperity of the real Benares silk industry. The weavers told me that their customers frequently asked for new designs, but, as stated above, in Benares the initial cost of transferring a design from paper to the cotton thread frame was almost prohibitive. The industry will receive a real impetus if a school of drawing and designs could be established at Benares which would among other things introduce new designs and teach the art of transferring them to the loom. This school of designs will also be of great benefit to the other art industries of Benares, *e.g.* brass and German silver work. I am also hopeful that considerable improvements can be effected even in the hand processes of warping and weaving. The experience of the Hewett Weaving School at Bara Banki and of several small hand factories in the province has conclusively demonstrated that automatic looms like the Salvation Army patent and the

Japanese looms are thoroughly well adapted for the weaving of plain Kashi silk and the profit on the weaving is much large than in the case of the ordinary fixed shuttle loom. I would suggest that the Benares Silk Weavers' Co-operative Association should try to introduce improved looms for the manufacture of this article. In Madura in South India I saw the Minakshi silk cloth factory using a new improved loom (known as the Ampthill patent loom) for weaving fine silk cloth with borders and fringes of various patterns. In the proposed experimental weaving station at Benares, provision is likely to be made for investigations in silk weaving and it is to be hoped that the looms for weaving *saris* and brocades will be improved or simplified. I am also inclined to think that the establishment in one of the centres of the silk industry in this province of a silk cloth power mill run on modern lines is likely to prove a profitable venture. The Sassoon mills of Bombay are well known and there is a very successful mill in the northern suburbs of Calcutta belonging to and managed by a Musalman firm. The question of freight on raw materials is not so important in the case of a silk mill as in cotton or woollen mills, and we shall have the great advantage of the hereditary skill and aptitude of our silk artisans. Owing to the steadily rising standard of life the consumption of silk fabrics is on the increase among the upper classes, and a market for all the products of the mill will probably be found in the province itself.

Gold and silver wire and allied industries.

62. The gold and silver wire and allied trades may conveniently be treated of here. The various branches of this industry are :—

(1) *Kandila Kashi*—Or beating out of a piece of plain silver, or silver plated with gold leaf, into thick wire.

(2) *Tarkashi.*—The process of lengthening out the thick wire into thin wire or thread, the thinness being regulated according to the purpose for which the stuff is wanted.

(3) *Tardabkána*—Or the flattening of the thin wire to produce what is known as *bádla*, used for making laces or *kámdani*.

(4) *Kalabatun*-making, or the twisting of the gold or silver thread round silk thread to produce a composite twist which is used in the weaving of brocade and similar stuff.

(5) The manufacture of *salma* (wire curled into a spiral form) and *sitara* (stars and spangles) used for embroidery. These are made out of either round thin wire or *bádla* mentioned above.

(6) The weaving of *gota* or lace with a silk or cotton warp and *bádla* woof.

(7) *Zardozi* or embroidery of fine cotton, silk, or velvet cloth with *salma sitara.*

(8) *Kamdani* or embroidery of cotton, silk or velvet cloth with gold or silver wire and thread.

The processes of the different stages enumerated above will be found described in considerable detail in Mr. Charles's Monograph on Gold and Silver Ware (pages 13, *et seq.*) and in Dr. Hoey's Monograph on Trade and Manufactures in Northern India (pages 110, 129 and 196); it is therefore unnecessary to explain them here again. The tools and implements used are of the simplest kind, and so far as I have been able to ascertain, except in the flattening of the thin wire to produce *bádla*, and in twisting gold wire round silk thread to manufacture *kalabatun*, no improved mechanical contrivances have been introduced within present memory. The artisans confine themselves as a rule to only one branch of the industry. They are recruited from all castes, specially in the four preliminary processes described above. The first three stages of the industry (lengthening out of the piece of silver into wire and beating it flat) demand some degree of physical strength, while *kalabatun* making is monotonous work that can be done by aged persons with some staying power. The wages in the first three processes are about four annas a day while a *kalabatun* maker earns only two to three annas daily. For reasons which I have not been able to ascertain, the manufacture of *salma* is the peculiar province of *parda* women who are as usual paid very low wages. In *sitara* making a certain degree of artistic skill is required and I found in Lucknow and Agra men earning eight to ten annas a day. The weaving of *gota* or lace is usually done in Lucknow and Agra by Khattris, both men and women, at their own homes. In Bareilly, there are over two hundred lace or *gota* weavers, a very large proportion being Musalmans. As nearly all the inmates of a house, adults as well as children, participate in the different processes, during the intervals of domestic work, it is difficult to make an estimate of the rate of wages. *Zardozi* and *kámdani* are in Benares restricted to Julahas, but in Agra I saw other castes also working at this trade. Considerable artistic skill is demanded in this work, and wages vary greatly. Some men earn as much as a rupee a day.

Centres of the Industry.

63. The chief centres of the industry in the United Provinces are Benares, Lucknow and Agra and, on a smaller scale, Bareilly. In Benares, the principal objective is the manufacture of *kalabatun* which is so greatly in request for the silk weaving of the city. Some *kalabatun* also used to be exported in former years to

Ahmedabad, Poona, Madura and other centres of hand-loom silk weaving in south India. In Lucknow and Agra, the branches of the industry most practised are the manufacture of *salma sitara*, the weaving of lace and embroidery work. Their development was probably due to the patronage of the Musalman courts. Bareilly has about three hundred persons engaged in the processes of silver wire drawing and flattening and as many lace-weavers. Very little gold wire is manufactured in Bareilly and there is no *salma sitara* or embroidery work. In all these towns, the different branches of the industry are in the hands of large dealers, usually Banias or Khattris who employ the artisans, occasionally on daily but oftenest on piece wages. In some cases a master workman employs other artisans under himself. Sometimes a dealer confines himself to one branch of the industry, *e.g. kandilakashi* or embroidery. Other dealers would often combine in their business two or three branches of the industry, *e.g.* in Benares many men purchase the thick wire from the *kandilakash* and sell it in the form of *kalabatun*. As mentioned above the manufacture of *salma*, the weaving of *gota* and sometimes embroidery work also are carried on at the homes of the artisans. In such cases the employer weighs out to the artisan all the raw materials (including cloth in the case of embroideries).

Decline of the kalabatun industry at Benares.

64. Within recent years, the business of *kalabatun* manufacture has suffered a serious decline in Benares. It is impossible to get even approximately accurate figures. The number of men employed in Benares in the various branches of the industry about fifteen years ago is said to have been as many as 2,500. I do not think more than a thousand persons are engaged in the industry now. The causes of the decline are—

(1) the use of gold thread imported from Lyons in France. The retail price of the imported thread is a little less than that of the hand-made article. The imported stuff has less gold or silver than country-made *kalabatun*, but it is finer, more glossy and more uniform than the latter. Moreover, for the same weight it is longer—consequently in weaving a particular piece of garment, a smaller quantity of foreign thread is required. Its use is therefore expanding very fast;

(2) the use of false smoked *kalabatun* in which there is no gold or silver (see a description of the process in Mr. Charles's monograph on gold and silver ware, page 15). Owing to the lack of proper organisation in the brocade weaving community, shoddy ware is often turned out nowadays and passed off to unwary customers. Similarly among the dealers in

is probably due to the " mint " system. There has been no marked change in recent years in the condition of the industry at Bareilly.

Technical Instruction.

67. I venture to think no technical instruction in schools is necessary for these industries in their present state of development, except perhaps in the matter of designs. The only way to arrest the decline of these industries would be their better organisation in small factories employing labour saving machinery on the system adopted by the braid and lace makers at Barmen in Germany or in different parts of France. If the industry ever reaches that stage, previous technical instruction for the hands will be useful and necessary.

Chapter III.—The Woollen Industry.

Supply of raw wool.

68. The chief obstacle to the progress of the woollen industry in these provinces is the scarcity of raw material of a passable quality. The sheep of the provinces yield a hard, dry and frizzly wool, almost devoid of natural grease. There is, moreover, a great unevenness of fibre and a tendency to the occurrence of dead hairs, which greatly diminish the value of the wool for manufacturing purposes. It would appear that the *gadarias* keep sheep almost as much for the profits derived from hiring out the flock for manure or selling them for the table as for the wool. Mr. Pim* estimates the provincial outturn of wool to be thirty-two thousand maunds. In 1901-02 the province imported twenty-eight thousand maunds of wool and exported thirteen thousand. In 1905-06 the imports and exports were seventeen thousand and thirteen thousand maunds respectively. The figures for 1906-07 were seventeen thousand and eleven thousand maunds respectively. The imported wool comes mostly from the Punjab and Rajputana. Comparatively smaller quantities are sent by Thibet, Nepal and Australia. The exports go mostly to Bengal, probably to be shipped out of the country. I do not think the import figures include Thibetan wool brought in every autumn by Bhotia merchants from the Gartok market and sold at Tanakpur and Haldwani at the foot of the Kumaun hills. During the winter these traders receive advances from the agents of the large Indian mills and exporters and stipulate to supply wool during the following season at a fixed price. They purchase the wool on their return to Gartok during the summer. Owing to the system of advances the Bhotias (mostly inhabitants of the district of Almora) have to bear all losses due to fluctuations in price. This hampers the trade, which also suffers from difficult communications. An improvement of the roads, specially over the Lipulekh pass, is urgently called for. The quantity of Thibetan wool placed on the Indian market has increased of late, but the extent of pasture ground in Thibet is limited and a very large expansion of this trade cannot be hoped for. Thus the central problem in the woollen industry is the supply of raw wool. I believe the question of improvement of local breeds of sheep is already engaging the attention of the Agricultural and Veterinary departments of the province.

* Monograph on the Woollen Ind...

Miranpur in tahsil Jansath in the same district, and at Lawar (tahsil Meerut) and Nirpura and Jawalagarh (tahsil Sardhana) in Meerut district.

(1) Muzaffarnagar.

There are about thirty families of Gadaria weavers in Muzaffarnagar and small numbers in all the surrounding villages. The local supply of wool is very limited. The weavers visit the wool markets in Eastern Punjab like Rewari and Gurgaon, where it is stated the wool is softer than Agra or Neemuch wool. The carding and teasing of the wool are performed by Musalman *dhunias* who are paid a rupee for every twenty-five *sers*. The spinning is usually done by women on the country *charkha* or spinning wheel. If the work of spinning is given out of the family it costs an anna and six pies per *ser*. The process of warping is very similar to that of cotton fabrics. A sizing of some coarse grain is employed for the cheaper blankets and of boiled wheat for the superior variety. The weft thread is not sized. The weaving is done on rude hand-looms. The usual width of a strip is twenty-one inches and a breadth of more than thirty-two inches cannot be woven because the weaver cannot reach further with his hands in throwing the shuttle. A speed of twelve yards a day is common with a twenty-one inch strip, but only seven or eight yards can be woven of the full breadth. The wool has three natural colours, *viz.* black, white and brown. The yarn is never dyed before weaving. Weaving is as a rule carried on in the open because faults in a black yarn cannot be seen distinctly inside the dark, ill-lighted rooms of the weaver. After the strips have been stitched together to make a blanket of the usual width, it is thoroughly washed in running water and kneaded. This process gives a better appearance to the texture of the blanket. Dyeing now takes place. (The yarn is not dyed because the subsequent process of washing takes off the colour.) Aniline dyes of the cheapest kinds only are employed for the different colours. The blankets when finished are sold to small local dealers, Kabuli traders, agents from the shops in the hill districts and army contractors. I was told that the demand from the Military department was smaller than it used to be. Some of the well-to-do weavers themselves take consignments of blankets to other towns.

The quality of the blankets is very fair and if the industry was properly organised I think a considerable sale could be secured both in the provinces and outside. At present it suffers from the want of capital. The weaver purchases his wool with advances obtained from money-lenders at a very high rate of interest, and he has not sufficient resources to keep a large variety of stock, to improve the quality of his goods or to advertise. The industry seems one eminently suited for small factories. Co-operative purchase of wool and sale of stock also will effect some betterment of the condition of

the weavers. Improvements in the processes and implements are also very desirable and a technical expert may be able to suggest some. I do not know whether any efficient hand machines are available for spinning and carding to replace the present slow and cumbrous methods. The looms now in use are very narrow.* If the fly-shuttle could be used with the country woollen yarn much broader strips could be woven and there would be an immense economy in labour. The matter deserves investigation by weaving experts. A "raiser" to give a better surface to the blankets woven is also a great desideratum. The use of the better qualities of synthetic dyes under proper conditions is likely to impart a much superior appearance to the blankets. There are many wealthy and public-spirited gentlemen in the Meerut division. The question of the improvement of the local blanket industry should be taken up by them.

(2) Najibabad and other places.

73. A very considerable industry in the weaving of horse and coolie blankets exists at Najibabad in the Bijnor district. Over a hundred families of Gadarias pursue the calling in that town. They do not grow sheep themselves but get the wool from Panipat, Rewari and Eastern Rajputana. The processes are practically the same as those described above for Muzaffarnagar blankets. As there is no river in Najibabad, the blankets are washed in well-water. No attempt is made to weave checks or stripes as there has so far been no demand for such goods. The blankets are usually sold to large dealers who come from outside and to Army contractors. There is also good export to Garhwal and the interior of Almora. I was told that the business in Najibabad blankets was steadily expanding. The suggestions for the improvement of the Muzaffarnagar industry apply to Najibabad also. Very fair blankets locally known as *lohis* are also made at Bhinga in the Bahraich district, but the industry is a limited one. Country blankets and *namdas* are charged 2nd class rates by the railways, the same tariff being applicable to piece-goods and the expensive blankets from Europe when booked from the seaports. A reduction of freight in the case of cheap country blankets is very desirable.

Woollen Industries in the hills.

74. The use of woollen garments and other articles is naturally much more extensive in the hill districts than in the plains. In the uplands of Almora, the Bhotias weave a *patiu* of very fair but rough quality. Pieces, eight and a half yards by sixteen inches, sell for about eight rupees each. Rough self-coloured rugs of various qualities (known as *chutkas* and *thulmas*) are also woven in fairly large numbers. *Pankhis* and *dhusas* (inferior shawls) are manufactured to a certain

* I have seen nice soft blankets woven in Srinagar (Kulu) of which the strips are quite 36 inches wide. The *dhusas* woven in Gorakhpur are 40 to 44 inches wide.

extent. Some Bhotias have also started the weaving of woollen floor rugs similar to the pretty artistic rugs imported from Thibet which are in great demand among tourists in the hills.

The local supply of woollen articles is, however, very much less than the demand. Consequently there is considerable import of blankets and rugs of European and Indian manufacture from the plains and of *pashm* and woollen shawls from the Punjab and Eastern Kashmir beside the usual imports of cotton and fibre fabrics. The cost of carriage is very heavy and difficulties of communications impede traffic in the winter when the demand is most brisk. The inhabitants are well off and many of them will readily buy fairly decent blankets and other woollen stuffs, if a better supply can be provided.

The present methods of wool weaving in the hill districts are very primitive. Very narrow looms are used for all fabrics, and even for the rugs of the Thibetan style only horizontal looms are in fashion. The processes of teasing and cleaning the wool and of washing and felting blankets are much inferior to those practised in the plains. Although many vegetable dyes are to be had locally, the knowledge of dyeing methods is very rudimentary.

In view of the fact that a large amount of wool passes through the hills on its way from Thibet to the plains, it is desirable that a portion should be worked up locally for the needs of the district. This will save the heavy cost of carriage now incurred in obtaining ready-made goods from the plains and also enable the people to get a fairly good class of woollen articles. A supply of *pashm* from Thibet can also be easily obtained if an industry in the weaving of *pashmina* goods can be created and developed. The Bhotia inhabitants of the district are mostly traders and are now very anxious to develope the subsidiary occupations of weaving and other home industries.

Efforts are being made by the district authorities, which I hope will prove successful, to establish a weaving school at Almora with expert teachers from Amritsar and other centres of the wool and *pashmina* industries. The aim of the school ought to be to introduce better looms and implements, improved methods of dyeing and steady disciplined work on the part of the artisans.

Dhusa manufacture at Gorakhpur.

75. In Gorakhpur, an enterprising Musalman, Munshi Rahmat-ullah, has built up an interesting business in the manufacture of *dhusas* made of a union of wool and cotton. The warp is mill cotton of twenties count, while the weft is wool, purchased locally or at Cawnpore. The price paid this year for wool has been about twenty-two rupees per maund. After the *dhunia* has carded the wool, it is given out to be spun.

by women at their own homes at six annas a ser. (Much finer yarn is required than for blanket weaving at Muzaffarnagar.) The warp is laid out in the ordinary manner, and rice starch is used for sizing. The loom is the same as the cottage loom for cotton cloths. The *dhusas* are about forty-four inches wide. About thirty weavers (all Julahas) are employed on piece wages in Munshi Rahmat-ullah's factory. They weave about six yards and earn five annas daily, which is a good wage for Gorakhpur. Five or six weavers do the same sort of work at their own homes. The *dhusas* are purchased by Calcutta dealers who export to Darjeeling and Bengal Terai tracts. They are not so stylish looking as the imported German shawls, but much warmer and more lasting.

Woollen carpe

76. The chief centre of the woollen pile carpet industry in the province is the district of Mirzapur whence it has spread to adjoining villages in Jaunpur, Allahabad and Benares. Woollen carpet weavers are also to be found in Agra and in much smaller numbers at Jhansi, Amroha (in Moradabad), Bulandshahr and Cawnpore.

(1) Agra.

77. In Agra, outside the factory of Messrs. Otto Weylandt & Co. the industry is in a languishing condition. There are not more than twenty looms, all owned by Musalman weavers. The wool is purchased locally in the bazar. The cheaper aniline dyes are used. The designs are crude and no patterns or design-books are kept. Only rugs are woven and the finished product is sold to dealers in the bazar. It is difficult to suggest any means of improvement for the number of artizans is too small for co-operation or the establishment of a school.

78. Messrs. Weylandt's factory has over sixty looms, employing more than five hundred hands. The wool is purchased locally; it generally comes from Rajputana. No shortage of supply is experienced, in ordinary years. Occasionally supplies are obtained from the Cawnpore mills. The teasing and spinning are performed on the premises by women who earn fairly good wages. The dyeing is also done on the premises. The proprietor gets one good dyer from Amritsar and trains a number of men locally under him. Vegetable dyes mostly are used. The cotton yarn for the warp and weft is purchased from the local mills. The weaving is done entirely by boys between nine and fourteen, to whom a reader dictates the stitches. Boy labour is of course more advantageous than adult labour because boys have more deft and nimble fingers and the wages are lower. I watched the boys for some time. They looked quite happy and the work did not seem to be arduous. The boys earn two to three rupees a month when learning the work and later on as much as six or seven rupees a month. The factory has a large collection of old designs. The work turned out is of very high

merit. Sales are generally effected direct with purchasers abroad as well as in this country. Some agents are employed in Europe.

Apart from the question of the training of dyers which will be discussed later on—the chief difficulty the factory has to contend with is shortage of labour. Very little parental control is exercised over the boys. Only a small proportion hope to rise to the position of a reader. As a result the boys are very irregular in attendance and often leave off just when they are beginning to be really useful. The conditions are different from those of a cotton mill where the parents as well as children find employment in the same factory. The proprietor does not think a system of half-time education would improve matters. I am inclined to disagree with him. If free education were imparted to the boys, say for two hours a day, specially with a view to fit them to earn fairly good wages at the cotton mills of the town, perhaps parents would be much more disposed to keep the boys at regular work at the factory. Importing labour from other districts is not feasible because the factory cannot provide work for the parents as well as the children.

79. The Agra Central Jail has a great reputation for the manufacture of woollen carpets. The wool is purchased from the Cawnpore mills. Much attention is paid to dyeing. Mostly vegetable dyes are used. Boys cannot be employed in the jail along with adult readers—consequently only adult prisoners are employed for weaving. They take about a year to learn properly. Practically all the jail looms are kept busy with Government orders and very little work is now done for the public.

(2) Jhansi.

80. In Jhansi, the carpet industry is limited to about thirty families of Musalman *kalinbafs*. Hand-spun cotton yarn is used and the wool is supplied by the local fleece. In the case of Hindu *asans* or prayer-mats the warp and weft are also of wool. The wool is obtained from local shepherds who also spin it. The weavers obtain advances from the dealers who afterwards buy the carpets. The demand is limited and except in the case of *asans* is gradually dying out. Only aniline dyes are used. The weavers informed me that it did not pay to use vegetable dyes for small quantities of wool and native customers preferred the bright tints produced by chemical dyes. I saw a few pretty rugs dyed with vegetable colours made to special order which showed that the art was not quite extinct.

(3) Amroha.

81. In Amroha, more cotton pile carpets are woven than woollen pile. Altogether the industry is a small one; the total number of looms does not exceed twenty. Hand-spun cotton yarn is used and wool is obtained from local shepherds. The dyeing is of very poor quality. There are two or three small factories where the workmen

earn about three annas daily on the piece wages system. No books of designs are used. Sales are effected in neighbouring fairs and occasionally to traders in large towns. The industry could be improved only by the importation of good artizans to teach local workmen or by sending local artizans for training to Agra or Amritsar, and the introduction of superior dyes. Something may also be done by better arrangements for the sale of the local products.

(4) Other places.

82. The industry in woollen carpets at Aurangabad in the Bulandshahr district or at Cawnpore is too small to require any detailed treatment.

Cotton pile carpets.

83. At Shahjahanpur and Farrukhabad, the carpets manufactured are mostly of cotton pile. They are generally of bed size and are often preferred to woollen carpets on account of their comparative coolness. The yarn used is sometimes hand-spun and sometimes machine made. A good deal of indigo is used for blue and black colours. Synthetic dyes are utilised for the other colours. The wages of the artisans are about the same as in woollen pile carpets. Owing to the recent rise in the price of cotton yarn the profits of the weavers have been cut down very low.

Mirzapur carpets.

84. The carpets manufactured at the small centres of the industry are generally consumed in the country. Those woven in Mirzapur and the surrounding area are mostly for export. Kunwar Jagdish Prasad estimates that nearly ninety-eight per cent. of the total production of Mirzapur is exported to England. A few bed carpets and Hindu prayer-mats are made in the district, but no cotton pile carpets or Musalman prayer-mats are woven.

The industry in Mirzapur is mostly rural. There are about four hundred weavers in Mirzapur town, but more than three thousand carpet weavers are to be found in the villages of the Bhadohi pargana north of the Ganges. The industry has extended to many villages in the Mariahu tahsil of Jaunpur district, and several villages in the Benares and Allahabad districts also contain carpet weavers now.

The weavers are of all castes, Hindu and Musalman; but whereas in the case of a Hindu, carpet weaving is only an occupation subsidiary to agriculture, the Muhammadan carpet weaver follows no other calling. Attempts have from time to time been made by large dealers in Mirzapur (both European and Indian) to introduce the large factory system, but they have not been successful. The industry is mostly of the cottage type. The boys of the family help in the weaving and the women in spinning, warping and other preliminary processes. A prosperous weaver generally has more looms than one and employs a number of journeymen workers.

The wool is mostly from local sheep, but there is a good deal of import now from Agra and Bundelkhand. Unless vegetable dyes are supplied by the dealer, synthetic dyes are used for all colours exeepting blue or black.

The system of production is described in detail by Kunwar Jagdish Prasad in his Monograph. The Mirzapur dealer gives an advance (sometimes in the form of yarn and dyes) to a loom-owner, who again gives advances to the journeymen weavers. The work is always paid for by the piece. The wages are exeeedingly poor. Kunwar Jagdish Prasad thinks that four to five rupees may be regarded as the monthly earnings of a Mirzapur weaver. This estimate seems to be unduly low. So far as I am aware even unskilled labourers earn about three annas daily in the districts of the Benares division. Anyhow the loom-owners as well as the weavers are in a hopelessly impoverished condition and are unable to subsist without the advances they receive.

Prospects of the Mirzapur Industry.

85. So far as the volume of the export business is concerned, Mirzapur does not seem to have suffered very much until quite recently. The figures in the traffic returns of the export of woollen rugs and carpets from the Benares block may be safely taken to represent only the trade in Mirzapur carpets. Between 1899-1900 and 1901-02, the quantity exported fluctuated between nine and ten thousand maunds. In 1902-03 it exceeded twelve thousand maunds, and in 1903-04 it went up to nearly thirteen thousand and five hundred maunds. The figures for the three following years are as below:—

1904-05	9,540 maunds
1905-06	11,277 „
1906-07	6,717 „

The sudden fall in the last year was probably due to inflated exports in 1905-06. Altogether these figures have a remarkable analogy to the similar figures for the Amritsar carpet trade.*

	Exports in maunds.
1898-99	2,581
1899-1900	3,683
1900-01 †	5,512
1901-02 †	5,670
1902-03	3,726
1903-04	3,102
1904-05	2,754

* Mr. Latimer's Monograph on Carpet-making in the Punjab.

† These figures are not quite accurate.

The causes of the rise and fall were probably the same in both cases. The popularity of the carpet in the European and American markets led to forced production. The workmanship and designs naturally deteriorated and the demand abroad was seriously affected. In Amritsar, according to Mr. Latimer, the industry has returned to more or less normal conditions and violent fluctuations are not likely in the near future. I am afraid the Mirzapur industry will decline still further unless early steps are taken to place it on a firmer basis.

Suggestions for the Mirzapur industry.

86. Amongst the larger dealers in Mirzapur carpets are two or three European firms. They have connections with merchants in Europe and America and receive orders for goods of definite designs and standards. They give out these orders to loom-owners and often supply the latter with good yarn, vegetable dyes and patterns of designs. One or two of these firms have also imported dyers from Amritsar to teach the local weavers. The influence of this class of dealers is generally towards the improvement of the industry except that the system of advances is demoralising to the weaver and the designs are generally of an occidental type which the weaver does not understand and consequently fails to render with skill. Many of the dealers, on the other hand, ship speculative consignments of carpet-bales at their own risk which are auctioned on arrival in London. This class of business is very harmful to the industry. The prices obtained are often very low and Mirzapur carpets have incurred a very bad name in foreign markets. It is possible that the inevitable decline in consumption will be a lesson to speculative dealers, and the exports will soon reach a normal condition, like they have already done at Amritsar. One hopes however, that if the dealers would combine and form an association to protect their interests much could be done. The Director-General of Commercial Intelligence some time ago framed a scheme for the standardization of carpet colours. I venture to think something may perhaps be done towards the standardization of quality. Dealers in Europe could be advised of the formation of the League in Mirzapur and requested to conduct business only with members of the League. It would take time to translate the idea into action; but in view of the interests involved it is worth attempting.

I am afraid it is too late in the day to attempt to banish synthetic dyes altogether from the Mirzapur market. Much may, however, be accomplished towards the reintroduction of vegetable dyes by concerted action on the part of the large dealers. Moreover some synthetic dyes now are quite good, if properly manipulated. The weavers should be taught the correct use of the synthetic dyes and also how to mix vegetable

wer.
eric.

Some of the jails have accumulated a considerable knowledge of dyeing processes and materials. There seems no reason why such knowledge should not be placed within the reach of persons interested in the industry, and a satisfactory system of instruction could perhaps be devised without much difficulty. This is a part of the larger question of the teaching of dyeing methods to which I have had to allude in various places.

As mentioned above, many of the dealers receive orders from their European and American constituents for particular designs, generally of a western type. It is impossible to ignore such specifications. Mirzapur has never been noted for the purity or excellence of its designs. I think the provincial school of design should always contain a number of intelligent carpet weavers, to be attracted if necessary by the grant of generous stipends. These weavers should be taught the principles of design and made to practise these principles in the actual weaving of carpets.* Only in this way will an impression be made on the designs of Mirzapur carpets.

Experiments should also be made by competent weaving experts to find out whether the loom and other implements as well as the processes of spinning and warping are not susceptible of improvement.

As regards the weavers themselves, I venture to think the only way to rescue them from their present impoverished condition would be by the spread of co-operative methods (1) for the purchase of raw materials and (2) for the sale of the finished products. The present conditions of the industry are very similar to those of the silk industry in Benares, where a co-operative association has met with a large degree of success.

* An account of the system followed at the Bombay School of Art will be found at page 15 of Captain Twigg's Carpet-making in the Bombay Presidency.

Chapter IV.—Dyeing and Calico-printing.

The displacement of vegetable by synthetic dyes.

87. The different indigenous dyes and the processes of dyeing are described very fully in Khan Bahadur Saiyid Muhammad Hadi's Monograph. With the exception of indigo practically all the native dyes are being replaced by synthetic products from Europe. Even chemical indigo is now used in some centres of industry, *e.g.* by the *dari* weavers of Meerut. During the five years between 1885—1890, the average annual import of aniline dyes into the provinces amounted to 1,576 maunds only. During the following five years the average was 5,755 maunds. In 1905-06, fourteen thousand maunds of aniline and alizarine dyes, valued at six and a quarter lakhs of rupees, were imported. The figures were still higher in 1906-07.

Local manufacture of dyestuffs. (a) indigo.

88. There has been a great falling off in the cultivation and manufacture of indigo in the provinces. Even in 1894, there were 1,835 factories which manufactured 61,317 factory maunds of indigo and furnished employment during the season of six weeks to 103,121 persons. In 1907, only 86 factories were reported which employed more than fifty hands at a time. The average exports between 1885 and 1895 had been over forty-four thousand maunds. In 1906-07, the total exports had fallen to 3,604 maunds. Gorakhpur is the only district where there is still a number of factories in the charge of European planters. Native landholders just make the manufacture pay with very economical management. The system of cultivation and manufacture of commercial indigo will be found described in pages 74-76 of Mr. Hadi's Monograph. Recently a seed-farm has been opened at Dasna* and much hope is entertained that the Java-Natal varieties will enable natural indigo to compete on better terms with the coaltar product.

(b) catechu.

89. Catechu or cutch is another important dye-stuff manufactured in the provinces. It is not, however, locally used very much as a dye and the methods of its manufacture will be described in a following chapter. As stated in paragraph 30 above, the cultivation of *al* (*Morinda citrifolia*) has practically disappeared in Bundelkhand. The only other locally grown vegetable dyes of any importance are safflower (*Kusum* or *Carthamus tinctorius*) and turmeric (*haldi* or *Curcuma longa*). The processes of the manufacture of commercial safflower and turmeric are purely agricultural. Safflower was at one time used largely in France for colouring silks and

(c) al.

(d) safflower.

(e) turmeric.

* Report of the Imperial department of Agriculture, 1906-07, page 17.

of *al* is now extinct in the provinces and the only kind of *kharua* cloth of which I saw the manufacture during my tours was at Khurja in the Bulandshahr district where sappan wood infusion is the agent employed. As regards women's *dupattas* the services of the *rangrez* are seldom required now. A woman wishing to dye her clothes can easily buy a few pice worth of aniline and alizarine dye and do the work herself. The colour is perhaps fugitive, but as the cloth is usually imported or mill-made, it has a comparatively short life and consequently very fast colours are not necessary. A professional dyer would probably be able to give a fast colour to the cloth, but his charges would be much too high.

Dye Factories.

93. In the midst of the depressing circumstances sketched above, it is pleasant to note signs of a reorganisation of the industry on right lines. During my tour in South India I was agreeably surprised to see the large number of successful dyeing factories established in recent years in the town of Madura. Synthetic dyes mostly were employed and practically all the work was done with handpower. The industry has been taken up by educated men of the middle classes and the factories give employment to a large number of artisans. The yarns dyed at these factories are considered to be much faster than can be dyed by a weaver at his own home and there is a great saving in cost. During my investigations in these provinces, I have often come across Madras dyed yarn, specially Turkey red yarn. Dyeing factories of this type are likely to be of very great benefit to the industry in this province. I understand that a dyeing factory has been established recently at Cawnpore by a prominent Indian firm, and I saw two small factories started at Kanauj in Farrukhabad within the last few months. The yarn is obtained from the Ahmedabad mills. (Sometimes it has to come from Ahmedabad to Kanauj *viâ* Cawnpore owing to the anomalies in railway rates.) The colours now dyed are mostly greens and blues. The dyed yarn is sold to traders in all parts of the provinces. With a scientific knowledge of the processes on the part of the manager and careful training of the workmen, such factories are bound to succeed. Only handpower is now used at the Kanauj factories, but I was informed by the proprietors that if the business expanded, steam power and processes would be introduced.

Cotton Printing.

94. A considerable industry is carried on in the provinces in cotton or calico printing. The processes will be found explained in Mr. Silberrad's *Monograph on Cotton Fabrics* and also in great detail in Mr. Hadi's *Monograph on Dyes and Dyeing*. The printing is done entirely by hand, the designs being rendered by wooden blocks. These blocks are usually made of *shisham* wood (*Dalbergia sissoo*), fitted at the back

with a handle. At all the centres of cotton printing, like Tanda, Farrukhabad and Sambhal in Moradabad, carpenters specialise in the manufacture of these blocks. The design is carved on the face of the block in very much the same manner as in wood engraving. The cloth is either hand-made, as at Moradabad, Bareilly or Aligarh, or mill-made as at Farrukhabad, Tanda or Lucknow. It is subjected at the different centres to various processes of washing and bleaching. Mordants are applied in all better class work, and several kinds of gums or thickeners are used to prevent the colours from running or passing beyond their proper limits. A certain proportion of vegetable and mineral dyes is still employed in cotton printing, but the synthetic products are gaining ground every year. As in the case of dyeing, the ordinary cotton printer has little skilled knowledge of the use of synthetic dyes, and his traditional dexterity with the vegetable dyes is of no avail in the manipulation of the modern product. A great deal of skill is necessary for a cotton printer. Great accuracy in working is required, in view of the rude table used in the trade, in bringing the block to the exact spot so as to prevent overlapping or the leaving of too much intervening space. Again, there will be distortion of design unless the sides of the block are kept perfectly parallel with the edge of the cloth. If the colour taken up is insufficient the design is too faint; if too much is taken, smearing and spreading will follow. Moreover, the artisan has to acquire considerable despatch because each block serves only such parts of a design as are in one and the same colour. In some of the Farrukhabad curtains as many as ten or eleven colours are used, and the number of different applications on one piece of curtain runs into several thousands.

Centres of t industry, Lucknow

95. Lucknow is one of the principal centres of the industry. Chintz, for which this city used to be so famous, is no longer in fashion. Mill-made checks, stripes and prints are cheaper and have a better finish, although the colours are fugitive. The industry at Lucknow is now mostly confined to the printing of *fards* (quilted shawl cloth). Some business is also done in bed covers and quilts. Mill-made or imported cloth is used. Alizarine dyes are employed as well as indigo and a small proportion of country dyes.* Mordants are utilized to make the colours fast. There are a few large firms who employ workmen on contract wages. Otherwise the middleman system prevails and the handicraftsman who may belong to any caste has no direct touch with his customers. The cost of Lucknow prints has much increased lately owing to (1) increase in price of cloth, (2) increase in price of fuel, (3) increase in prices of

* The processes will be found described in Hoey's *Monograph on trades and manufactures*, page 83 *et seq.* and in Hadi's *Monograph on dyes and dyeing*, page 44 *et seq.*

mostly Musalman. There is no regular system of training. Piece-work wages prevail and the men earn three to four annas a day. The finished cloth is exported by road to Akbarpur and thence railed to Nepal, Bhutan and the Tarai, where Tanda prints have the greatest vogue. Some of the large dealers have shops of their own in the consuming area. The business must be expanding, for I think the number of workmen now employed much exceeds five hundred. New colours and patterns are sometimes suggested by the consumers, but no system of advertisement or commercial travelling prevails and it is doubtful whether for the present class of purchasers any such system is necessary. There is practically no consumption of Tanda prints in the provinces or for export to Europe. No attempts to cultivate such a trade have been made. The prints of Tanda are not so pretty as those of Bulandshahr, Farrukhabad or Lucknow, but they are cheaper and fairly artistic shades in red ochre, and chocolate are obtained.

The *thappas* or wooden blocks used for printing in Tanda are made locally. The artisans are mostly Sayyids. During my visits to Tanda, I saw only two men who could draw or design. The others carve the dies from old paper patterns. From paper the pattern is first transferred to talc, and then to the wooden block. The Tanda *thappas* are exported to Calcutta, Farrukhabad, Benares and other places.

Muttra.

99. Calico-printing is one of the principal industries in the Muttra district. It flourishes in the city of Muttra and also in Brindaban. The dealers supply mill-made cloth to the printers who are paid piece wages which include the cost of washing, mordants and dyes. The usual process is for the cloth to be first washed and then treated with myrobolan. It is then printed in a black colour upon which red print is superposed. A second print of black is finally superposed on the red print. The cloth is then washed again, dried and calendered. The printer earns a little more than three annas a day. He does the work at home and the factory system of Tanda does not prevail. The wooden *thappas* or blocks are made locally of *shisham* wood (*Dalbergia sissoo*).

Patterns, mythological scenes, and Hindi and Sanskrit verses are printed on *dhotis, saris, angochhas, dupattas* and hadkerchiefs, which are sold to pilgrims and also largely exported. The outturn was estimated* in 1896 to be fifty thousand rupees, but if the price of the "raw" cloth is included, it must be very much more now.

Jahangirabad and Jafarganj.

100. The calico-printing of Bulandshahr and Fatehpur, although not large in volume, deserves mention on account of the good art displayed. In both districts

* Traffic Inspector's report.

the industry is said to have been fostered by Mr. Growse. In Bulandshahr, Jahangirabad in tahsil Anupshahr is the centre of the industry. The same classes of goods are produced as in Farrukhabad. The work is carried on by a small number of firms who employ the handicraftsmen. There are about a hundred *chhipis* engaged in the industry at Jahangirabad. In Fatehpur, coarse cloths are printed at Kishanpur on the Jumna. Finer fabrics are utilized at Jafarganj in pargana Tappa Jar, where the bed covers, curtains, floor cloths and awnings produced are of exceptional merit. Only portions of the design are stamped; the centre is filled in with elaborate flowing patterns, painted by hand, and inscriptions in the Arabic character are generally introduced in the border. A drawing is first made in charcoal, and to this the pigments are subsequently applied. There are two main styles of painting: Arabic letters and geometrical figures (including beautiful curves) or birds and animals, specially peacocks. In the floor cloths all the printing is done with blocks. A beautiful specimen of Jafarganj awning is to be seen at the Lucknow Museum. The great obstacles to the development of the industry are (1) the poverty of the artisans and their inability to advertise, (2) the out-of-the-way situation of Jafarganj. The artisans cannot migrate to Fatehpur owing to its distance from a river, and washing in running water is considered essential for the development of the finer peculiar efficiency of different kinds of water is recognised by European printers. I would suggest the starting of a co-operative society for the Jafarganj printers worked as an affiliated branch of the Fatehpur co-operative bank, and the establishment of a small sale depôt at Fatehpur or Cawnpore.

In Agra the craft of calico-printing is followed by a number of artisans. The printing is done generally in black or black and yellow. Patterns are also produced by printing with powdered mica or pieces of tinfoil.

101. In Muzaffarnagar, calico-printing exists on a fair scale at the town of Kairana. The work is an imitation of Jahangirabad in Bulandshahr and belongs to Musalman *chhipigars*. A few workmen in the Muzaffarnagar district make handsome cloth *pardas* with glass beads and other tinsel, but are unwilling to teach others. These *pardas* become tawdry and tarnished after a time.

At Aligarh there is a good deal of calico-printing now in the various styles of Farrukhabad, Bulandshahr and Muttra.

In the district of Barabanki after the cloth has been printed, it is worked to a certain extent with cotton embroidery. Very pretty effects are thus obtained.

The printed *doghas* and *razais* of Katra in the district of Gonda have a fair local reputation. *Garha* cloth is imported, narrow strips from Nagina and wide strips from Nawabganj, Barabanki. There are about twenty families of printers in the village belonging to different castes. The business is not always a hereditary occupation. *Dhobis* are employed for bleaching the cloth. The raw materials used consist of myrabolans (from south Mirzapur) the gum of *dhau* or *Anogeissus latifolia* from the Terai, iron sulphate, *gur* or molasses and various indigenous dye-stuffs as well as alizarine and aniline colours. One of the printers told me that vegetable *al* (which was formerly employed for red colours) gave a fast dye and also strengthened the fabric, whereas artificial alizarine, though much easier to handle, loosened the texture of the cloth and the dye is fugitive. Dealers from the Terai bazars are the principal purchasers of the finished material which is used by Nepalese women for petticoats. For the ordinary *dogha* or *razai* the demand is not so brisk as formerly owing to the competition of the finer prints of Lucknow and Farrukhabad. Even for the Nepalese market, the rivalry of neighbouring printing centres, *e.g.* Belibahadurpur in Basti has begun to be felt.

Cotton printing is also to be found in Unao, Basti, Mirzapur, Benares and Jaunpur. In the last-named place some gold and silver leaf printing is also done. Everywhere the business is reported to be in a fairly prosperous condition.

Lines of development.

102. It will be evident from the above account that though the industry of dyeing has been decaying, calico-printing is still carried on in a large number of centres all over the provinces. There is a good local market for printed cottons. They are also much appreciated in other parts of India and abroad on account of the beautiful patterns brought out by the system of block printing. Lines of development for the calico-printing industry will probably be found in—

(1) The introduction of newer and better designs. This can be done only by the establishment of schools of drawing and design, like the one suggested above for silk. It is not necessary to start a school at every centre, but one or two representative workmen from each place could probably be trained in a central institution.

(2) Placing the producer in more direct touch with the consumer. Fashions vary very fast in an article like cotton prints. Neither the present dealers nor the craftsmen belong to a class which keeps itself informed of the movements of taste in this country or abroad. Much can be done in this direction by exhibitions, industrial and commercial journals, and also perhaps by co-operative associations.

(3) Co-operative production. I am not very hopeful about the success of co-operation in calico-printing. The price of the original cloth much exceeds the cost of labour and of the raw materials required for the dyeing and printing processes. Large stocks also have to be maintained. The profits made by the dealers under the present system are not very high.

(4) The establishment of small private factories by educated men possessed of adequate technical knowledge. Comparatively little power machinery or expensive plant will be required in a calico-printing factory, and I think immense improvements over present processes could be effected by the adoption of clean, accurate and scientific methods. The educated owner of a small factory will also have a great advantage in the matter of gauging the wants of the public and adopting modern marketing facilities. I have heard of the establishment of one such factory at Cawnpore since my last visit there.

(5) Improvements in the mechanical process of printing. In European countries the expensiveness of block printing has led to its displacement by many labour-saving appliances, such as the flat press and the cylinder machines. It is difficult to say whether the adoption of similar methods in this country will not rob the printed fabrics of all the charm that is now ascribed to the hand block process. For the cheaper and coarser kinds of printing it is possible that the perrotine machine will turn out as good work as is now done by hand. This machine is much in use in Alsace and in Belgium. Each machine wields three blocks, and designs in three colours are stamped in one round. I have not seen a machine of this type, but it is stated that it can be managed by a single workman assisted by two children and effects great economy of labour. Even without the adoption of any machinery, better results can be obtained with the blocks if the printer is provided with a proper table with pins to fix the cloth to it. I would also suggest the adoption of a proper colour tub, and the employment of a boy assistant to keep it constantly brushed so as to present an even surface to the die.

(6) Improvements in dyeing methods.

Improvements in dyeing methods.

103. I have already expressed my belief that it is impossible to reintroduce the more æsthetic native dyes to the absolute exclusion of the imported stuffs. Nor am I certain that it will be at all desirable to do so. The synthetic dyes are undoubtedly

cheaper and far easier to handle. An impression is widely prevalent that the indigenous dyes are all fast while the chemical dyes are fugitive. As stated above some of the country dyes, *e.g.* turmeric and safflower are by no means fast.* Vast strides have been made in recent years in the production of synthetic dyes which give fast colours and pleasing tones. "The truth is that the ancient art of dyeing with vegetable stains had in the course of ages been perfected. The more fugitive and otherwise untrustworthy substances had been found out, the really serviceable had been tested, and a dyer knew what he had to depend upon, and for what he could depend upon it. On the other hand, when new dye-stuffs came every day to be produced in the laboratory, all use of them was experimental; and it is only after many failures that satisfactory results begin to be achieved . . . . The failures in aniline dyeing were obvious . . . . with the introduction of alizarine and of what is known as the "direct" series of colours, printing in artificial dye-stuffs entered upon a stage of success already marked enough to show that the falling back upon old world methods was a counsel of despair, not warranted by the actual condition of things . . . . The last word of science is to the effect that alizarine colours are more permanent than vegetable dyes."† The dyers and calico printers of these provinces are at present entirely ignorant of the proper way of selecting and manipulating the aniline and alizarine dyes or of combining the same with native dyes or mordants and bleaching materials. There is consequently a deplorable waste of labour and material, and the results achieved are far from satisfactory. That the business of dyeing yarn and cloth with imported dyes can be a very profitable one is illustrated by the great success of the dye-houses established by native capitalists at Madura in South India. I would suggest the establishment of at least one experimental school of dyeing directed by an expert who would be capable of ascertaining the correct methods of combining native materials with European products and teaching the same to the dyers and printers. The school should also endeavour to popularize in the province the use of the better kinds of synthetic dyes.

104. An improvement in dyeing methods would give a powerful impulse to the industry of calico-printing. It will also be of very great benefit in the cognate trades of silk and wool dyeing. One of the difficulties that confronts the manufacturer of woollen blankets in the province is connected with the bleaching and dyeing of yarn to produce pleasing checks or self-colours. Investigations in dyeing are also call

* See in this connection an account recently contributed to the Proceedings of the Asiatic Society of Bengal by M[illegible] of a series of experiments conducted by him regarding the fastness of the vegetable dyes of India.

† Article on Cotton Printing in the 10th edition of the Encyclopædia Britannica.

in the interests of the hand-loom and the power-loom weaver. I think I am right in saying that even the mills here find themselves unable to dye yarn of certain colours and when necessary have to import dyed yarn. Hand weavers also in many cases dye imported yarn, and if good methods were popularized, it would be easier to weave the checks and prints now imported in such voluminous quantities. The moribund industry of dyeing will thus receive a new lease of life. Private capitalists would be able to establish dye houses for the supply of dyed yarn to hand weavers. Without the introduction of up-to-date dyeing methods neither hand-looms nor power-looms will be able to compete with the coloured fabrics of Europe.

Chapter V.—Fibres and Paper.

Sann Hemp.

105. The cultivation of *sann* hemp or *Crotolarea junesa* has much increased in these provinces in recent years. In 1907-08 the area under hemp was 158,000 acres against a normal area of 107,000 acres. The largest areas are to be found in Bareilly, Pilibhit, Fatehpur, Banda, Allahabad, Benares, Mirzapur, Jaunpur, Unao and Partabgarh. The crop does not require much irrigation, and cultivators find that the fibre commands a ready sale in the larger markets (like Benares, Shikohabad, Chandausi and Pilibhit) for export to Europe. The demand for this fibre received a great impetus at the time of the war in the Philippines, when the supply of Manilla hemp for the European markets fell short. At the beginning cultivators and dealers were inclined to pursue the suicidal policy of adulterating the fibre with earth and dirt. The notice of the Agricultural department was drawn to this, and it is believed that the efforts of the department have stopped this pernicious practice. Separate figures for the export of *sann* are not available, but it contributes largely to the total export figures for hemp and other fibres, which amounted in 1905-06 to 2,99,000 maunds valued at over fourteen lakhs. In 1906-07 the exports ran up to 4,03,000 maunds valued at twenty-two lakhs. The figures must have been higher in 1907-08. To these figures should also be added the amount of 3 lakhs of rupees annually shown in the traffic returns as the export of jute from these provinces to Calcutta. So far as I am aware no jute is grown in these provinces, and although some jute grown in the Nepal Terai may pass through the provinces, there is little doubt that the so-called jute of export is a commercial name for the *sann* hemp of the Benares division.

Bhabar grass.

106. The next most important fibre of the provinces is the grass *Ischæmum angustifolium*, which is known as *babru or bhabar* in the districts of Saharanpur and Bijnor, *baib* in Shahjahanpur, Pilibhit and Kheri and *bankas* in the eastern submontane districts. There are large tracts of *bhabar* grass in the Government forests. In Saharanpur it is to a small extent locally utilised for cordage; the Rohilkhand and Kheri grass is exported to Shahjahanpur where it is manufactured into *baib* matting; from Bahraich and Gonda the grass goes mostly to the Lucknow paper mills. Large quantities of the grass are also sent from these provinces and the Nepal Terai to Bengal for the use of the paper mills near Calcutta. Bhabar grass grows to a small extent in the hilly parts of Bundelkhand. I have been informed that it will be difficult to increase the outturn of the Government forests.

Aloe Fibre.

107. Aloe or *agave* fibre is also coming into prominence. It grows plentifully on the sides of the East Indian and Oudh and Rohilkhand Railway embankments. Private gentlemen have started plantations at Etawah and Jhansi. Messrs. Allen Brothers of Cawnpore have an agave farm at Najafgarh, a few miles from Cawnpore. They intend manufacturing strings and ropes as soon as the plants are sufficiently matured. In the autumn of 1907 I was shown some fine samples of fibre extracted from the early grown plants in Messrs. Allen's farm. A syndicate has also been formed in Etawah for working the plantations there. Mr. Hayman (a former Deputy Director of Agriculture) had informed me that he was making experiments in planting agave on poor soil incapable of bearing more valuable crops and also in feeding cattle on agave leaves. I have seen very good ropes and twine made out of aloe fibre at Jaunpur jail. The industry of extracting the fibre is also being practised at Chunar on the East Indian Railway, and Sandila on the Oudh and Rohilkhand Railway. Several moderately-priced machines for decorticating aloe fibre on the field have been advertised in recent years, but I do not know whether any of them is really efficient. The Economic Botanist of these provinces has been engaged for some time past in identifying and classifying the different kinds of agave found here. When this work is finished, I believe the Agricultural department will investigate the best methods of cultivating and propagating the varieties that are economically the most valuable.

Other Fibres.

The hilly tracts in Mirzapur produce a fibrous grass known as *bagia*, from which twine and ropes are made for the Benares and Mirzapur bazars.

The *kus* reeds that grow wild over many parts of the country are made into mats known as *kusasans*, which have an extensive sale among Hindus, notably in Benares.

Munj grass grows abundantly in many districts. It is utilised for thatching and also for the manufacture of matting. Some of the jails turn out very good mats, but I have not seen the *munj* mat industry carried on in an organised scale outside the jails.

The question of the utilisation of plantain fibre had been mentioned at the Naini Tal Industrial Conference. Subsequent inquiries showed that there was no regular cultivation of the plantain in these provinces. The scattered trees in orchards and village hamlets are not likely to yield sufficient fibre for commercial work.

108. In spite of the abundance of raw materials, there is very little organised attempt in the provinces to utilize local fibres for the manufacture of good ropes, twine, cordage, gunny, etc. There would not be any extensive market for this class of goods in rural tracts, for the cultivator himself generally makes out of the produce

of the village fields the ropes and twine he requires for irrigation, cattle and thatching. In the towns, however, the present supply is of a very poor quality. The ropes are made of hemp adulterated with mud and last only a very short time. All persons requiring good rope have to get it made at home. The jails make good ropes and string, but they are primarily for the use of Government departments. There is a

Cawnpore Mill.

jute mill* at Cawnpore belonging to native capitalists. It has a paid-up capital of three lakhs and seventy-five thousand rupees, 1,544 spindles, and seventy-five looms. The average number of persons employed in 1905-06 was 533. The mill was closed at the time of my visits to Cawnpore, and I was unable to ascertain how far it utilized materials obtainable in the province or what style of goods it turned out. There are no rope works on an organized scale in the provinces—unless we include the hand industry in the manufacture of rope carried on at Dhumri in the Etah district and a few other scattered places.

Sacking manufacture.

109. Coarse sacking or *tat* is made in many places on a small scale out of *sann* hemp. In the Partabgarh district the industry is beginning to be organized and fairly large exports of *sann* hemp matting have taken place in recent years to the neighbouring large towns and to Bengal and Bombay. The *sann* is cultivated by all castes. When the crop is matured, it is steeped in water and the fibre is extracted and spun by the cultivator himself. The mat weavers are practically all Kurmis dwelling in villages in the vicinity of the town of Partabgarh. The implements are very rude. No sizing is resorted to. The loom is very similar to the Sitapur *tat* loom described by Mr. Silberrad in his Monograph on Cotton Fabrics, page 21. No shuttle is used, and strips only about sixteen inches wide can be woven. One man weaves about eight to ten yards a day. I feel confident that a weaving expert could easily devise a more efficient loom. Dealers who often give advances in money to the weavers, purchase the strips of mat from them and export to other places. There is a growing demand for cheap matting in the provinces as well as out of it. The article can also be utilized as bags for the transport of grain. If improved implements were used, the industry would give employment to large numbers in every *sann* growing district. It is an industry which is likely to suit a small capitalist with capacity and enterprise.

Brush manufacture.

110. In Cawnpore, there is a brush factory managed by Messrs. Begg, Sutherland & Co. It is worked by electric power, and turns out all kinds of brushes for personal, domestic and factory requirements and also for the use of the army. With

* Dwarkadhish Jute mills.

the exception of the experts at the head of the business, all hands have been locally trained. The brush business of the late Wense Factory has been taken over by an Indian firm. There is also a small brush factory at Meerut, which employs only hand labour. I have been told that most of these firms have to import a portion of their fibres from Deccan and the Madras Presidency, although they get all the bristles locally. At present these brush factories try to cater mostly for the army, but articles for sale in the bazars are also being manufactured in increasing numbers.

Baib matting.

111. In Shahjahanpur the baib matting industry gives employment to about one hundred artisans, all Musalmans. The grass is imported by dealers from the forests of Pilibhit and Mailani (Kheri). The mat-maker buys the grass from the dealer according to his requirements. The price of the grass at Shahjahanpur varies from Re. 1-4-0 to Re. 1-12-0 a maund. The mat-makers usually work at their own homes, but there are four or five small factories which employ journeymen mat weavers at three annas a day. The processes of weaving are very crude. The work is monotonous and comparatively little skill is required on the part of the weavers. A quicker weaving process would be of great benefit to the industry. The finished matting sells locally at four annas a square yard and when bordered with cloth at five annas a square yard. The cloth is sewn on by *mochis*. It is believed that white ants do not attack baib matting and its use in the provinces is increasing. From the conditions of the industry, I do not think there is any room for co-operation. A better loom as mentioned above is a great necessity, and the consumption is likely to increase if orders for matting from other stations were complied with more promptly than they are now.

Suggestions for fibres.

112. I think Indian capitalists should find a good investment in organized factories (using improved tools and machinery, but not necessarily steam power at the beginning) for the production of good twine, ropes, cordage, sacking, brooms of various kinds, and brushes out of the raw materials obtainable in the province. It should be borne in mind that the present export trade in *sann* hemp is on a somewhat unstable basis. As mentioned in the *Indian Trade Journal* of June 4th, 1908, there is a great likelihood of Manilla hemp re-establishing its position in European manufactures, in which case the demand for *sann* hemp is bound to suffer. It is therefore very desirable that steps should be taken early to utilise locally at least a portion of the hemp grown in the provinces. It is difficult to suggest what Government can do to encourage an industry of this kind except by supplying information to intending capitalists regarding the sources of raw materials, markets, purchase of machinery, and similar matters. The

present railway rates for the cheaper kinds of matting are rather high. A reduction of rates will be of great benefit to the industry.

Hand-made Paper.

113. At one time an extensive hand industry in paper flourished in these provinces. Muttra, Lucknow, Jaunpur and Kara in the Allahabad district were the principal centres. The process of manufacturing the coarser kinds was described at pages 127 and 128 of Dr. Hoey's Monograph on the *Trades and Manufactures of Northern India.* The industry is now practically extinct in the three last-named places. Some paper is manufactured by hand in the interior of the Almora district from the fibre of the *boru* plant, but I have had no opportunity of seeing the process. In the town of Muttra the hand industry still manages to survive. Old paper is purchased from the Aligarh postal press and elsewhere and thoroughly soaked in water. It is then converted into thin pulp by treading and kneading. The pulp is again washed (the water of the Jumna being considered particularly suitable) and then steeped in a solution of *sajji* for some days. The workman then lifts out some of this paste on a framework covered with a reed mat. This on being drained forms into a sheet, is dried by exposure to the sun, treated with flour paste and again dried. The paper is then glazed by hand rubbing and sold to local dealers. Old rags and cordage are not used in the Muttra industry. The workmen are mostly Musalmans, employed in a number of small factories. So far as I could estimate, about 250 persons are employed in paper-making and another seventy-five in simply glazing mill-made paper. Native traders consider such hand glazed paper more durable and use it for their account-books. The wages in Muttra are very low* and there is very little export now to other towns. The industry has no chances against mill-made paper, and I have no suggestions for its improvement.

Consumption of paper.

114. The consumption of paper in the province will appear from the following figures:—

Year.	*Imports.*		*Exports.*	
	Thousand maunds.	Thousand rupees.	Thousand maunds.	Thousand rupees.
1898-99 ...	30	3,18	29	5,13
1905-06 ...	44	4,37	37	6,62
1906-07 ...	55	5,80	36	6,40

* About two to four annas per day, which is low for a western district.

The imports come mostly from Bengal, and from Calcutta and Bombay ports. The exports are mostly from Oudh (*i.e.* from the Lucknow mill). It will be noticed that the exports are more valuable than the imports, weight for weight. This is because the exports consist practically entirely of high grade paper manufactured at the Lucknow mills, while a large proportion of the imports is made up of thin and brittle German paper used for the lithographed vernacular books and newspapers.

Lucknow mill.

115. The mill at Lucknow affords a striking instance of successful business enterprise on modern lines managed to a large extent by Indians. The paid-up capital in 1905-06 was eight lakhs of rupees, and seven hundred daily labourers are employed on the average. The following descriptions of paper were manufactured—printing, brown, coloured, blotting, white and buff cartridge, cream and yellow wove, azure and creamlaid wrappers. The production in 1904 was 5,496 thousand pounds, or, roughly, about sixty-seven thousand maunds, valued at six lakhs and eighty-two thousand rupees. In 1905, the quantity produced had risen to 7,095 thousand pounds valued at eight lakhs and sixty thousand rupees. The mill supplies largely to Government, and from the absence of advertising, one concludes that it experiences no difficulty in the disposal of its produce.

The other paper mills in India are located at Howrah (Bally mills),* Titagarh and Kanknara near Calcutta (both Titagarh mills), Raniganj (Bengal mills), Gwalior (Sindhia mills), Bombay (Girgaum), Surat (four small mills), and Poona (Reay mills). The total quantity of paper made in 1905 was 44 million pounds.

The materials most in use at the Lucknow mills are (1) rags, (2) old paper, (3) *baib* or Bhabar grass from Nepal through Bahraich and Gonda, (4) old hemp cordage collected in Southern Oudh and Benares division. Very little wood pulp is used as its cost (more than £15 to the ton at the mill) is a very heavy item. The railway freight from port to mill is a considerable portion of this cost. The mills are beginning to experience difficulties in obtaining an adequate supply of old cordage (new hemp is too stiff and too expensive for the manufacture of paper) and also in securing the desired proportions of white and coloured rags.

Chemical wood pulp.

116. It would therefore be a great advantage if wood and bamboo pulp and wood meal for the manufacture of paper could be produced in the provinces out of raw materials locally obtainable. The question of the manufacture of bamboo and wood pulp in Burma was a little time ago investigated by an expert.† I have also

* This mill ceased working in 1905, but I believe has since been re-established as a part of another mill in Bengal.

† Mr. R. W. Sindall's report published by Superintendent of Government Printing, Rangoon.

recently seen it stated in the papers that a mill to manufacture pulp and paper is likely to be set up in the neighbourhood of the Tata Iron-works on the Bengal-Nagpur Railway. But as pointed out by Mr. Imms, the manager of the Lucknow paper mills* the manufacture of wood pulp in Burma (or any other province) will not be of much assistance to the industry in this province on account of the heavy cost of land transport. In this connection it has been suggested that the wood of the rhea tree (*Acacia leucophlœa*) which grows in the plains districts will furnish pulp of very fair quality, the bark being used for tanning purposes. There are also large areas under spruce and silver fir in the Himalayan forests. The timber of these trees is not very valuable and it has been conjectured that the wood can be transported at a reasonable cost to some convenient place on the railway where pulping mills may be set up. The authorities of the Imperial Forest Research Institute are at the request of the local Government investigating the question, and samples of wood have been subjected to test and experiment in England by experts. The results so far are very promising. The matter is still under inquiry. As has been mentioned above the present railway rate on wood pulp is very high. Considering that it is only a raw material and pretty heavy in weight it should be carried over the railways at the lowest or first class rates.

Mechanical wood pulp.

117. The wood pulp referred to above is what is known as chemical wood pulp. The wood is chopped up and crushed and then boiled in huge digesters with caustic soda or treated with bisulphites. The result is a pure cellulose which is of great value for high class paper. Mechanical wood pulp is obtained by cutting the wood (poplar, fir, pine, etc.) into small logs and then applying large grindstones to the logs with hydraulic pressure. The product thus obtained is mixed with water and passed through screens. The excess water is subsequently drained off and the pulp is obtained as a thick sheet. Mechanical wood pulp serves for the inferior grades of paper only on account of the shortness of fibre and the presence of wood resin which resists the action of bleaching agents. It is, however, the main ingredient of the class of paper of which the consumption in these provinces is increasing very fast on account of the growth of a reading public and a newspaper press. The kind of wood required for mechanical wood pulp is available in fair quantities in the hills, and as chemicals will not be required in large quantities and hydraulic power will not be difficult to obtain, the prospects of a mechanical wood pulp industry are I think even more favourable than of chemical wood pulp manufacture. The question merits the attention of capitalists.

* Paper read at the Lucknow (unofficial) Industrial Conference, March 1905.

Chemicals for paper making.

118. Paper mills in this country have to pay very high prices for chemicals. A small proportion of sulphuric acid is used, and if the sulphur industry is developed as is proposed by the Geological department in connection with the working of copper mines, this difficulty will be obviated. Large iron works in the country will also solve the problem. Large quantities of caustic soda and resin are also used, and both substances are now imported. The Lucknow mill tried some years ago the resin distilled in the Government forests but did not find it of sufficiently good quality. The manufacture of resin will be treated of below in connection with the chemical industries. I shall also discuss the question of the manufacture of soda when considering the chemical industries and the utilization of the alkali deposits of the province. It may, however, be mentioned here that for some years the Lucknow mills attempted to make soda out of *sajji*, but the results were not satisfactory in spite of the low prices then prevailing for *sajji*. An experiment with soda ash obtained from Messrs. Reinhold & Co. of Agra also proved unsuccessful.

Expansion of the industry.

119. With an increasing spread of education among the masses, the consumption of paper in the province is bound to develop very fast. There is also the possibility of obtaining a market in other parts of India not so favourably situated with regard to raw materials. The feasibility of starting another paper mill deserves the attention of enterprising capitalists. Such a mill should be located at a place where water will be easily available and new sources of labour and of raw materials can be tapped. Much will of course depend on the results of the wood pulp investigations referred to above. Otherwise either Gorakhpur (where labour is cheap and plentiful and supplies of Bhabar grass is obtainable in large quantities in the Tarai forests) or the vicinity of Hardwar (where water will be always available and the Saharanpur forests will yield fibrous grass) suggest themselves as suitable sites.

Papier-mâché.

120. The papier-mâché industry may be conveniently described here. There are a few artisans at Bijnor, Budaun and Miranpur in the district of Muzaffarnagar who manufacture fancy articles like small boxes, inkstands and cigar cases, but the industry is altogether unorganised. The number of artisans is too small for any system of co-operative supply or production. The prices at present asked for will not permit of any extension of the market. At Jaunpur, about twenty-five years ago a former Collector imported skilled artisans from Kashmir who trained a number of local workmen and a small semi-Government factory was established. For some years the institution flourished and a fair number of articles was turned out. Only ornamental articles were however manufactured, and the market was very limited

The artisans obtained better paid employment in other provinces and the papier-mâché factory sank for a time to the level of a book-binding shop. Some skilled artisans have recently been employed and I understand fairly attractive articles are again being manufactured. The only chance for the revival of the papier-mâché industry lies in the manufacture of the cheaper styles of toys. The demand for even expensive toys is daily increasing in the country and papier-mâché easily lends itself to the manufacture of a large variety of toys. The growth of the newspaper press and a general increase in the consumption of paper, as shown above, will provide plenty of raw material. Labour could perhaps be recruited in the first instance from the paper-makers of Muttra. The industry should be taken up by a small capitalist with ideas and enterprise.

Chapter VI.—Food grains.

Flour mills.

121. The principal agricultural staple of the province is wheat and it is also the chief article of food. The average annual outturn of wheat in the province is estimated to be a little over two million tons. Only a fractional portion is exported. In these circumstances the milling of wheat for internal consumption would in any other country be one of the chief industries. In the United Provinces it is still domestic work. Cawnpore has two large flour mills and Lucknow has one. A flour mill was started at Allahabad two years ago and is doing well. The mill at Benares has stopped the manufacture of flour. Smaller mills (some with stone rollers) are to be found in Agra, Lucknow, Cawnpore, Farrukhabad, Gorakhpur and other districts. There is room for more enterprise in this direction. The traffic figures are given below :—

Imports in thousand maunds.

	1905-06.	1906-07.
From the Punjab to—		
Meerut block	76	110
Agra	101	188
Allahabad	105	95
Benares and Gorakhpur	7	24
Rohilkhand and Kumaun	22	56
Oudh	55	100
	366	523
From other sources	10	10
Total Imports ...	376	533

Exports in thousand maunds.

From—		
Meerut	24	25
Agra	49	58
Allahabad	212	335
Benares	2	3
Rohilkhand	2	...
Oudh	...	2
Total ...	289	423

The exports from the Allahabad block are mostly to Bengal and the cities of Calcutta and Bombay. It will be noticed that our imports come chiefly from the Punjab, where there are flourishing mills at Delhi and Umballa close to our border. Some of the mills in this province depend to a large extent on military contracts, but others (*e.g.* the Lucknow mill) cater for the general market. In this direction there is naturally a greater demand for *ata* than for *maida*, *suji* or *bran*.

Prospects of flour mills.

122. So far as I have been able to ascertain, there is no difficulty in selling the produce of mills in the markets of the larger towns. At present there is practically no market-pushing. One or two mills occasionally employ their wheat purchasers to go round the bazars with samples of their products. There is no caste or social prejudice against mill *ata*, but many people consider that *ata* milled in iron roller mills is not as nutritious as the hand-crushed product. The stone roller mills are supposed to be better in this respect than iron mills. I do not know if there is any foundation for this belief. I have heard many native consumers express perfect satisfaction with mill *ata*. In the towns mill *ata* commands about the same price as hand-made *ata* except in the hot weather and the rains, when hand-crushing is more arduous and mill *ata* sells cheaper. In the smaller towns it will be a good plan for an intending capitalist to feel the market by starting a small concern worked with an oil engine. He will in this way gradually accustom the people to mill flour and in time the mill stuff will come to be preferred on account of its purity. Hand-made *ata* sold in the bazars is frequently adulterated with inferior grain. After a market has been developed, the business can be expanded and steam power set up. This policy has to my knowledge been successfully adopted in a town in these provinces.

The domestic industry of milling wheat is almost entirely confined to women. In Dehra Dun practically all the wheat is crushed at the numerous water mills in the district, and very little wheat is milled at home. The two mills worked with oil engines in Dehra Dun town are well equipped but have not yet developed a large business in wheat milling.

So long as other and more remunerative employment is not found for the village women who now carry on the milling of wheat, either for the consumption of their own families or at very low wages for large cultivators and dealers, I do not think there is much chance of the mill industry capturing the rural markets. In the towns, on the other hand, as stated before, there is considerable room for power mills, and there is also the possibility of a market being found at the seaports and other tracts where large colonies of *ata*-consuming people are now settled. It would be much

better to export *ata* to these places and keep the bran for cattle at home than to export raw wheat.

Difficulties of the milling industry.

123. I do not think the Government can help the domestic industry of wheat-milling in any way. As regards the power-mill industry—

(1) reductions in railway freights are urgently called for. At present the special rates in force are in many instances fifty per cent. higher for *ata* than for wheat. Flour does not take up more space in the trucks than wheat and the difference in value between the two commodities is not large enough to justify the great difference in freights. A separate note on the subject has been submitted to the Government.

(2) Millers are at present much handicapped in their purchase of raw material and sale of flour by the bewildering differences that prevail in the various bazars regarding weights and measures. The question of the prescription or standardisation of weights and measures was considered by the Government a few years ago, but no steps were taken because it was thought that the great mass of the people seemed to find little practical inconvenience in the existing state of things and there was no popular desire for Government interference in the matter. Moreover in any scheme of prescription or standardisation, machinery must be created to see that unauthorised weights were not used and considerable opportunities of levying blackmail will be offered to underpaid subordinates. The steady growth of commerce is daily accentuating the difficulty and I am afraid something will have to be done sooner or later. It is difficult to suggest a remedy. Perhaps the least objectionable method will be a specific provision of law that in all contracts the Government system of scales and measures will be presumed to have been used in the absence of an express stipulation to the contrary.

(3) Improved facilities are wanted, as in the case of all other power mills, for the supply of efficient engine-drivers, carpenters, smiths and fitters. This point was considered at the Naini Tal Conference, and a definite and comprehensive scheme was drawn up.

Bakeries and biscuit manufactures.

124. A few bakeries conducted under European supervision are to be found in the larger towns. It is difficult to suggest any improvements in the native bakeries except that they might use better raw materials and be conducted on more sanitary principles. The United Provinces have no proper biscuit factory. One firm at

Lucknow advertises its biscuits, but the process of manufacture or method of packing is not different from that employed by native bakers; consequently the biscuits do not keep well. I am informed the Hindu Biscuit Company, Limited, of Delhi is doing well, as also one or two factories at Calcutta. I have seen Delhi biscuits sold on railway platforms in the western districts and also in the larger bazars. The taste for biscuits among Indians is growing very fast. Musalmans have no objection to them, and I think a large proportion of Hindus would also consume "Hindu" biscuits. They are an obvious convenience for railway travelling and are also of much request for the use of children and invalids. Provincial figures of the consumption of biscuits are not available, but the import figures for British India are instructive :—

Year.	*Imports in thousand pounds.*
1902-03	1,690
1903-04	4,786
1904-05	4,265
1905-06	5,205

The chief ingredients of biscuits, *viz.* flour, sugar, butter and milk, can all be had of good quality in the province and a biscuit factory need not import any raw materials. For packing, tins manufactured out of old kerosine oil tins and packing case tins could perhaps be used. This promising industry must be left for private enterprise and I do not think Government can do anything at this stage.

Rice-hulling.

125. Like the milling of wheat, the hulling of rice is a domestic industry in these provinces. There are one or two rice mills worked with steam power in Basti, and the oil engine mills at Dehra Dun do a fair business in the hulling of rice. These provinces will, however, never be able to compete with Bengal or Burma in the rice markets at Calcutta or Chittagong. The population of the larger towns do not consume much rice. In the circumstances there is not much prospect of rice-hulling becoming an organized industry in the near future. At the same time large farmers will probably find it to their advantage to adopt some of the handpower rice mills now placed on the market by Calcutta firms like Messrs. Jessop & Co.

Other grains.

126. Pulses (*dal*) of various kinds are much consumed by the people of these provinces and there is of course an extensive use of gram for horses. Most of the flour mills in these provinces have machines to crush gram and split peas. The usual practice is for the owner of the grain to get it crushed at the mill at a fixed rate. With the rise in the wages of domestic labour this style of business is likely to expand a good deal in the near future.

Chapter VII.—Sugar.

Production and consumption.

127. Sugar-refining is perhaps the most important industry of the United Provinces. About 1¼ million acres are annually sown in sugarcane in the province, and the produce may be roughly valued at ten crores of rupees. The chief sugar tracts are Saharanpur, Muzaffarnagar, Meerut, Bulandshahr, Farrukhabad, and all the districts of the Rohilkhand division on the west, Sitapur, Hardoi, Kheri, Fyzabad, Gonda, Sultanpur, and Bara Banki in Oudh, and all the districts of the Benares and Gorakhpur divisions with the exception of Mirzapur. The traffic returns in sugar were as below :—

	1905-06.				1906-07.			
	Imports.		*Exports.*		*Imports.*		*Exports.*	
	Lakh maunds.	Lakh rupees.	Lakh maunds.	Lakh rupees.	Lakh maunds	Lakh rupees.	Lakh maunds.	Lakh rupees.
(1) Refined	10	86	5½	66	9·7	71·5	5·6	62·9
(2) Unrefined	4·8	39	14	110	7·9	66·8	15	102 8
(3) *Gur, rab,* &c. ...	2·4	12½	52	225½	4·6	22	40	156
Total ...	17½	138	71½	402	22·2	160	·61	322

The imports in *gur* came mostly from Bengal (I think chiefly for the sugar factories). The refined and unrefined sugar imported came almost entirely from the ports, *i.e.* from foreign countries.

Indigenous methods.

128. The indigenous methods of growing cane and refining sugar are fully described by Mr. Hadi in his monograph on the sugar industry. In most parts of Rohilkhand the cultivators press their cane into juice in iron mills, and the *khandsari* converts the juice into *rab* and thence into *khand* and *kachchi chini*. Elsewhere, on the other hand, the cultivator himself boils the juice into *rab* or *gur* (mostly the latter), which is then sold either for consumption or to a sugar refiner who manufactures *pakki chini* out of the *gur*. The processes are wasteful in many ways :—

(1) In many eastern districts (*e.g.* Jaunpur) the old stone mill is still used for pressing the cane. I believe in the northern parts of the Gorakhpur division wooden mills are most in vogue. These mills do not extract as much juice as an efficient iron mill does.

(2) Even where iron mills are employed, they are usually supplied by men with very small capital and no organizing power. The mills are as a rule ineffieient and soon get out of order. It has been estimated that good mills would increase the juice extracted by almost one-half over large areas.

(3) Where the juice is boiled down into *gur* by the cultivator, he follows most wasteful and primitive methods. As no lime is added to the juice the proportion of crystals obtained is comparatively small, and modern sugar refineries consequently pay only a low price for such *gur*.

(4) The processes of the *khandsari* and the sugar-refiner of the east also admit of many improvements. The question is a highly technical one, and as the various points have been separately treated of in the bulletin of the Agricultural department and the writings of Mr. Hadi, it is unnecessary to discuss them here.

All these circumstances make the indigenous sugar far more expensive than the sugar refined in modern power factories in this country or the sugar imported from Java or Mauritius. It will be noticed in the traffic returns quoted above that the imported refined sugar was valued at about eight and a half rupees per maund in 1905-06 and a little over seven rupees in the following year, while the exported sugar (*i.e.* the product of this province) was valued at nearly twelve rupees per maund. The indigenous sugar commands a higher price because it is believed to be free from any objectionable contamination and also on account of the prevailing idea that it is much *sweeter*, weight for weight, than imported sugar. Even factory sugar produced at Cawnpore sells at a higher rate than imported sugar. It is not, however, likely that these causes will for ever exclude foreign sugar from the markets of these provinces. The import figures are rising every year. The indigenous sugar is selling at a lower figure, and the profits of the cane cultivator and the sugar refiner are being daily cut down very fine.

Power refineries.

129. Till recently there were only two sugar factories in this province conducted according to up-to-date modern methods. The Rosa sugar factory in Shahjahanpur is worked in conjunction with a distillery, and its history can be traced as far back as 1805. It is now managed by Messrs. Carew. & Co. and has a capital of sixteen lakhs. In 1905 a dividend of 8 per cent. was declared, and in 1906 the annual dividend was 6 per cent. This factory has its own plantations in the Shahjahanpur and Kheri districts. The Cawnpore sugar works are managed by Messrs. Begg, Sutherland & Co. who also own similar concerns in Behar. The ordinary capital is ten

lakhs and preferenee shareholders own five lakhs. No dividends were declared between 1897 and 1900, but between 1901 and 1905 the company declared an average of over 12 per eent. There was no dividend again in 1906, but I believe the eircumstaneos of the year were peeuliar. This faetory buys its *gur* in the Cawnpore market and also in Behar and the Benaros districts. A third European sugar faetory has reeently been established at Partabpur in Gorakhpur in the extreme east of the province. I have not visited this faetory, but have been informed that it promises well. The average number of persons employed in 1907 was 489.

Native eapitalists have recently ereeted two sugar factories. In the faetory near the agricultural station at Cawnpore, belonging to Messrs. Gauri Dat Tulsi Ram, work has commeneed and it is intended to get the *gur* from Tirhoot and the Gorakhpur division. The Unao sugar faetory belongs to a limited eompany and is managed by Messrs. Mulchand Murlidhar of Cawnpore. This faetory also started work last cold weather. A company has also been formed at Allahabad to erect a sugar faetory on modern lines in that town.

Recent literature on sugar.

130. The sugar industry has for several years reeently engaged the serious attention of the Agrieultural department, and the improved prôeesses of Khan Bahadur Saiyid Muhammad Hadi have been frequently demonstrated with great success in several plaees. Persons interested in the improvement of the industry are referred to the following publieations for a diseussion of the question from various points of view :—

(1) Agricultural department bulletin deseribing Mr. Hadi's improved methods (reprinted as an appendix to the proeeedings of the Benares Industrial Conference).

(2) Mr. Moreland's article in the *Agricultural Journal of India*, January 1907.

(3) Proeeedings of the Calcutta Industrial Conferenee, 1906. (Paper read by Mr. Jordan, of Messrs. Martin & Co., Calcutta.)

(4) Proeeedings of the Allahabad Industrial Conferenee (printed in *Modern Review* for May 1907). Papers read by Messrs. Moreland, Hadi, Radharaman, and K. C. Banerji.

(5) A series of articles on sugar in *Capital* of May and June 1907.

(6) "Notes on Sugar in India" by Mr. Noel-Paton, Direetor-General of Commercial Intelligenee.

Detailed information about the improvements in indigenous manufaeture elaborated by Mr. Hadi will be obtained on applieation to him at Partabgarh.

To any one wishing to study the methods of the power industry of sugar refining I would recommend the following works:—

(1) Sadtler's Industrial Organic Chemistry (Lippincott, 1906).

(2) McIntosh's Technology of Sugar (Scott, Greenwood, 1907).

(3) Prinsen Geerligs—On cane sugar and the process of its manufacture in Java (Norman Rodger-Altrincham, 1906).

Lines of development.

131. In view of the action that is already being taken by the Government in the matter of the sugar industry it is not necessary to discuss the possible methods of improvement in any detail. The various suggestions may be thus summarized:—

(1) Improvements in the methods and processes of cultivation.—Matters which are being studied by the Agricultural department. It will suffice to mention that a ton per acre has been considered the normal outturn of sugar in India, while in Java the average produce for the five years ending 1903 was 3·44 tons per acre.

(2) Improved cane-crushing mills.—The stone and wooden mills still worked in many districts should as soon as possible be replaced by iron mills. I have often been told by cultivators using stone mills that the juice extracted by iron mills has an oily flavour, and as much of the juice is consumed raw by cultivators and labourers during the pressing season, it is a disadvantage. I am, however, convinced that the great superiority of iron mills has only to be demonstrated in stone mill tracts in order to effect the necessary substitution. Demonstrations in this respect could at a very small cost be given in all stone mill tracts by court of wards estates and other public-spirited landholders.

(3) Improved iron mills.—Mr. Hadi says that the mills most suitable for immediate introduction are the three-roller Nahan mills, the three-roller Behea mill, the four-roller Babu mill sold by Mr. Simpson of Mallikpur, Bulandshahr, and the three-roller mills of Mr. Perfect of Bara Banki. As pointed out by Mr. Moreland, agencies for the supply of efficient cane mills and their maintenance in good order will not only remove the most urgent want of the sugar industry, but are likely to prove great commercial successes. Only a small capital is required at the start, and the enterprise should receive immediate attention from the middle classes of the province. A company with this object was projected at the Allahabad Industrial Conference in April 1907 and a capital of over fifty thousand rupees was promised,

but the promoters have since resolved to establish a modern sugar-refining factory instead. That with enterprise and organisation the business can be made remunerative is proved by the success of the iron foundry of Babu Shivashankar Prasad of Akbarpur in the district of Fyzabad where a large number of sugarcane presses is now manufactured. There is also a smaller concern at Moghalsarai. Mr. Perfect's sugarcane mill factory at Bahramghat in the Bara Banki district has also been referred to above.

(4) Improvements in *gur*-making.—The present defective methods have been described above. The chief difficulty lies in the fact that the liming of the juice makes the *gur* almost black and quite unsaleable in the Indian market for consumption as *gur*. The Agricultural Chemist of the province is engaged in investigating whether any modifications can be suggested in *gur*-making that will produce more crystals without sacrificing the colour. I venture to think that if the *gur*-maker felt certain that his product would be purchased by the refiner at a good price (*i.e.* better than what he gets from the *gur*-eater), he would have little hesitation in liming a portion at least of his juice and manufacturing partly for the refiner and partly for the Indian market. For this reason it is necessary to demonstrate the advantages of liming and also to put the refiner in touch with the cultivator. The latter object would be easily accomplished if the number of modern factories making sugar from *gur* increased in the province. As regards demonstrations, I am informed that Messrs. Begg, Sutherland & Co. themselves carried on demonstrations one year in Shahabad (a Behar district bordering on Ghazipur, Ballia and Benares) with very satisfactory but somewhat temporary results. The matter deserves the attention of the Agricultural department.

(5) The adoption of Mr. Hadi's processes for the manufacture of *khand* and refined sugar from cane juice.—It was the intention of the Government to have several of Mr. Hadi's factories at work during the whole of the cold weather of 1907-08 in different districts in order to prove that sugar can be manufactured in this way not only better, but cheaper than by the processes of the *khandsaris*. Unfortunately the drought caused severe damage to the cane crop and only four factories could be worked within the year. The results have been separately published.

(6) Construction of power factories consuming *gur*.—Mr. Hadi's processes are not well adapted to the manufacture of sugar out of the *gur* produced in Oudh and the eastern districts. As I have said above, I do not think it would be difficult to persuade the cultivators of these tracts to lime a portion of their juice if they were certain of a demand from refineries. Even now the *gur* of Benares and Gorakhpur has a considerable market among the factories in Behar and Cawnpore. I am afraid it would be extremely difficult to introduce the Rohilkhand system in Benares and make the cultivators carry their juice to a central factory to be converted into sugar. Mr. Hadi's processes can however be adopted by a zamindar who sows a large area of cane in *sir* or who can persuade his tenants to bring the juice to him. In these circumstances I think there is a very good opening for power factories consuming *gur* in the divisions of Benares and Gorakhpur and in Oudh. There is every reason to anticipate success for a factory established in the heart of the *gur* country, *e.g.* at Azamgarh, especially if it is run by a zamindar or zamindars of influence who will be able to utilize their ordinary agents for the purchase of *gur*. I may mention that such factories need not use animal charcoal for refining the sugar. The Cawnpore factories do not use any impure substances. Without the adoption of the large factory system, it is doubtful whether the sugar industry of the country will for any length of time be able to compete with countries following the most scientific processes, both agricultural and industrial, in the manufacture of sugar. In this connection the remarks made by the Director-General of Commercial Statistics in the *Review of the Trade of India* in 1906-07 are very pertinent. "The fact that even at the present prices a well-equipped cane country can maintain the contest with beet, offers a lesson both of encouragement and of discouragement to India as a producer. It shows what can be done by a cane industry embodying all the most modern practice, but it also shows that even if beet sugar were out of the market, the Indian industry with its primitive methods would—except in the recesses of the continent—be at the mercy of Java and Mauritius."

(7) The establishment of factories consuming cane instead of *gur*.—This is of course the normal type of a modern sugar factory. In these provinces, however, the cane area is usually so scattered, and each cultivator sows

such a small area in cane, that a factory of this kind will have to deal with an enormous number of cane-growers. This type of factory cannot therefore be recommended for this province. I am afraid that except in special tracts where the area under cane is unusually large, even composite factories working on cane during a part of the year and on *gur* during the remainder will not be found practicable at present. It is possible, however, that the cultivators might change their habits and grow more cane in the area adjoining a factory if they felt certain of the cane being always taken over at a fair rate by the factory.

Chapter VIII.—Tanning and Leather manufacture.

Population statistics.

132. After sugar and cotton, leather is the most important industry in the province. The following figures are taken from the occupation table in the census statistics of 1901 :—

	Actual Workers.					
	Total.		Partially agriculturists.		Dependants.	
	Males.	Females.	Males.	Females.	Both sexes.	Total.
Tanneries, etc., owners and superior staff.	36	20	7	...	59	115
Tanneries, etc., operatives ...	52	4	2	...	47	103
Leather dyers	5,429	1,003	240	21	10,481	16,913
Shoe, boot and sandal makers ...	50,498	10,427	3,503	471	80,229	141,154
Tanners and currriers ...	59,483	18,235	9,320	2,057	92,567	170,285
Water bag, well bag, bucket, and ghi-pot makers.	1,330	54	19	2	1,370	2,754
Sellers of manufactured leather goods.	3,230	398	332	23	6,844	10,472
Total ...	120,058	30,141	13,423	2,574	191,597	341,796

Condition of the hand industry.

133. The tanner and the shoe-maker are to be found in almost every village in the province. The shoe-maker calls himself a *mochi* and considers himself socially superior to the chamar or tanner. Some Musalmans have also taken to the manufacture of leather goods. Indigenous tanning cannot be said to be localized in any particular centre, but boot and shoe-making is of course practised to a great extent in the large towns, like Meerut, Agra, Lucknow, Cawnpore, Allahabad and Benares. In Cawnpore the existence of the Army Factory and two large private factories has given rise to a considerable industry in the manufacture of leather goods. In Meerut, where coach building is a rising industry, several firms also manufacture harness and saddlery mainly out of materials imported from Calcutta, Cawnpore and abroad.

The manufacture of ornamented shoes of the native style is everywhere giving place to the making of boots and shoes of European shape and of saddlery, harness, bags, portmanteaux, etc. Some ornamented shoes are still made in Lucknow and in Jalesar in the Etah district, but the industry is a declining one. The great bulk of the finer ornamented shoes now consumed in the provinces comes from Delhi where the artisans have considerable skill in the working of tinsel on leather. Saharanpur had at one time a fair number of artisans employed in the tanning of *sábar* (a

kind of deer skin) and the manufacture of *sábar* articles. I was informed that *sábar* skins were much more difficult to obtain now and the consumption of *sabár* goods has also gone down in the Rajputana states where at one time they had a great vogue. Embroidery in silk on deer skins is still carried on at Gorakhpur. I could, however, trace only two families engaged in the art. The designs and colours are garish ; otherwise the work is careful. At present there is no demand. Perhaps there may be an improvement in this respect if better designs are introduced. The *koras* or old-fashioned riding whips for which Fatehpur is noted are made of cotton, not of leather, and will be described in the chapter on small art industries. Country-fashioned shoes are manufactured in every large village, the chief difficulty the *mochi* has to contend with is in dyeing the leather. He has begun to use aniline dyes without a knowledge of their manipulation and the results are far from pleasing. The village Chamar generally makes up the bhisti's bag and also the irrigation bucket or *mot*. The custom generally is for a Chamar attached to a hamlet to supply the residents with a fixed number of shoes and *mots* in return for the carcases of all the animals that die in the village. The villager has to purchase anything that he might want extra. Boots and shoes of English fashions are only manufactured by *mochis* in the towns. The supply of leather for this industry is very limited. Owing to the wasteful processes, country tanned leather of good quality is expensive. The large tanneries of Cawnpore have no leather to spare for the bazar. The town *mochi* has therefore to depend on supplies obtained from one or two small tanneries in Cawnpore or from Calcutta. The *mochis* receive no training whatever in the processes of manufacture. Some of them use sewing machines, but all the other tools are antiquated. There is a very limited supply of lasts in the provincial market. The *mochis* have no knowledge of the economies that can be effected in cutting out leather. Lastly no organisation exists in the business of sale. With the exception of one large firm in Agra, a few small shops in the larger towns, and the harness and saddlery trade of Cawnpore and Meerut, no attempt has been made by small capitalists in the province to organise the manufacture and sale of hand-made leather goods.

Miscellaneous Leather articles.

134. The North-Western Tannery at Cawnpore manufactures miscellaneous leather articles like bags, portmanteaux, holdalls, etc., of very good quality. I do not know of any other factory in the provinces which goes in for this style of goods. For cheap and well-made articles of this type there is bound to be an increasing demand. I would recommend to the notice of capitalists the manufacture of purses, straps, letter-cases and writing pads, cigar and cigarette cases, bags and portmanteaux, knapsacks and

holdalls, footballs, camera cases, music carriers, luggage labels, etc. I do not think very elaborate machinery is required for the manufacture of such articles. Cricket balls are made to a certain extent at Meerut, but the processes are altogether primitive, the business is in the hands of untrained and illiterate artisans, and it is a marvel that balls of a very fair quality are turned out.

Bookbinding.

135. Bookbinding is a lost art in India. The ordinary *daftari* has neither skill nor artistic perception. The materials used are as a rule of a very inferior quality and the workmanship is poor. Enormous advances have been made in recent years in the art of bookbinding.* With the spread of education and the growth of a reading public, bookbinding will be a lucrative profession. It is an industry which could perhaps be taught at the industrial schools of the provinces and I have no doubt many Musalman youths will take it up.

Art leather manufacture.

136. Art industries in leather are conspicuous by their absence from the provinces. If a supply of proper leather could be secured, a great variety of effective and handsome articles could be turned out by the workmen who at one time found employment in manufacturing ornamented shoes. Among other articles I may mention book covers, boxes, panels, and artistic blotting pads. There is little prospect of any development of the art industries in leather without the adoption of scientific tanning processes. At present owing to defective curing the goods emit an unpleasant smell and perish quickly.

Deductions from traffic figures.

137. The local industry in leather has on the whole suffered considerably (1) by the large demand in Europe and America for Indian hides and skins, and (2) by the competition of foreign-made goods. An idea of the rapid changes that are occurring will be obtained from the following comparative figures of traffic returns in 1901-02, 1905-06 and 1906-07 :—

	Imports in thousand rupees.			*Exports in thousand rupees.*		
	1901-02.	1905-06.	1906 07.	1901-02.	1905-06.	1906-07.
Dressed hides	1,31,	48,	1,42,	7,83,	31,	1,
Raw hides ...	15,42,	19,49,	29,05,	29,76,	82,42,	1,17,80,
Dressed skins	9,	14,	9,	4,20,	85,	1,41,
Raw skins	5,98,	15,95.	14,89,	14,75,	52,20,	41,11,
Total ...	22,80,	36,06,	45,45.	56,54,	1,35,78,	1,60,33,
Leather, unwrought	2,72.	7,78,	4,43,	2,35,	2,01,	2 76,
Leather, wrought (excepting boots and shoes).	7,18.	5,24,	11,27,	23,85,	26,53,	21,32,
Total ...	9.90.	13,02,	15 70.	26,20,	28,54,	24,08,

* See Zachnsdorf's *Bookbinding*. (George Bell, 1903.)

No separate provincial figures for boots and shoes are available, but the import figures for boots and shoes for the whole of India are interesting :—

	Rs.
1901-02	20,29,000
1902-03	21,80,000
1903-04	27,93,000
1904-05	24,59,000
1905-06	34,43,000

The imports of dressed and raw hides and skins come mostly from the Punjab and Rajputana, and the exports go almost entirely to the seaports. It will be seen that the difference between exports and imports in this class of goods (representing the net exports of this province) was about thirty-four lakhs of rupees in 1901-02, and rose to practically one crore of rupees in 1905-06. In the following year the difference was a crore and fifteen lakhs. It is true that a great part of this rise is accounted for by a phenomenal increase in prices. It has been estimated* that between 1897 and 1906 the price of hides went up 85 to 95 per cent. The increase in the four years' interval we have taken was not, however, so large. Consequently it is clear there is a great contraction in the supply of hides and skins for the local industry. Another disquieting feature of the traffic figures is that there is a notable decrease in the export of dressed hides and skins. This shows that local industry has no longer any share even in the preliminary process of dressing the goods exported. Similarly the increase in the imports of unwrought leather indicates that the local supply is not sufficient for the existing demand among leather workers for properly tanned leather. The comparatively satisfactory figures for wrought leather (excluding boots and shoes) are due to the fact that the Government Factory and Messrs. Cooper, Allen & Co. export large quantities of leather accoutrements for the use of the army in other parts of India. (In 1906-07 there was a sudden increase in the imports of wrought leather, coming mostly from Bombay and Mysore. I have not been able to ascertain the cause. It probably represents army supplies obtained from the Bombay leather factories.)

Modern tanneries.

138. All the tanneries in the province employing modern methods are located at Cawnpore. The Government Harness and Saddlery Factory employed 2,337 hands in 1907. Messrs. Cooper, Allen & Co. had an establishment of 3,122 operatives. The North-Western Tannery employed 782 persons. The only other tanneries are those of Mr. Shewan and M. Abdul Halim. Both these are comparatively small concerns.

*See *Indian Trade Journal*, 29th December 1906.

Neither Messrs. Cooper, Allen & Co. nor the North-Western Tannery sell unwrought leather in the market. They find their own manufactures absorb all the leather they can tan and curry. Consequently leather tanned according to improved methods is very scarce in the Cawnpore market as well as in the other towns of the province. It is a mistake to suppose that all the leather goods manufactured in Cawnpore at the numerous small shops are of leather tanned by European methods. The Stewart Factory at Agra was established in the eighties by an enterprising resident of that town who had received a training at the Cawnpore Government Factory. For a time the Military department patronised the factory and it prospered. The Army orders were subsequently discontinued and the proprietors had to run into debt to adapt the factory to the production of other classes of goods. Working capital ran short, and the business had to be made over to creditors who unfortunately had no knowledge of the leather trade. As a result, the factory was wound up, and the premises which occupies a very good site for a leather factory remained unused for several years. During the last few months it has passed into the hands of a syndicate including the original proprietor and also some capitalists of Bengal, and it is understood that the establishment of a tannery on modern lines is contemplated. That there is room in the tanning business for capable men with technical knowledge and comparatively small capital is shown by the remarkable success of Mr. Shewan. His factory was established a few years ago; already his leather had a great reputation amongst leather workers in all parts of the provinces.

Tanning processes.

139. Mr. Walton in his monograph on *Tanning and Working in Leather* has described the primitive as well as the modern methods of tanning. A very good account of both methods will also be found in the article by Captain Stewart in Watt's *Dictionary of Economic Products*, volume IV, page 605. The new process of chrome-tanning is described by Mr. Chatterton in the paper contributed by him to the Calcutta Industrial Conference (1906). I may mention here that some chrome-tanning is also done by Messrs. Cooper, Allen & Co. of Cawnpore.

Restricted supply of hides.

140. The chief difficulty that the European tanneries in Cawnpore have to contend with is the restricted supply of hides. There is a very great demand for manufactured goods, but the companies cannot extend their business for want of hides, in the purchase of which they find in the Government factory a formidable rival. The firms interested naturally desire the imposition of an export duty on hides, and argue that the consuming countries cannot do without Indian hides and skins, while they have already imposed prohibitive import duties on dressed and tanned hides

from this country. The price of bark has also increased considerably in late years. The dressing of skins is difficult in this province because the bark most suitable (*Cassia auriculata*) is not locally obtainable. The question of bark supply will be discussed below.

Defects in the indigenous industry.

141. Turning to the indigenous industry, the chief defects in the present processes appear to be—

(1) over-liming on the part of the country tanners;

(2) antiquated tools for fleshing and removing the hair;

(3) insufficient attention given to bating;

(4) the actual tanning period is too short and the process is not properly graduated;

(5) very little attempt at currying.

It does not seem that any very complicated machinery or power is required if the country tanners wish to adopt some improved methods. The existing processes, besides turning out very inferior leather, involve great waste of lime, bark and labour, chiefly because the operations are on such a small scale. No doubt this is the reason why, in spite of its poor quality, indigenously tanned leather does not sell much cheaper than leather imported from Calcutta. The principal obstacle towards improvement is want of capital. Proper tanning takes a long time; consequently much capital is locked up. The country tanners belong to the poorest and most improvident castes. They have neither individual capital nor the spirit to combine for industrial purposes. As regards boot and shoe making and the manufacture of wrought leather, a number of shops in Cawnpore employ partially improved methods, the workmen being mostly ex-employés of the big factories. Throughout the province, however, although the use of the sewing machine is gradually spreading, only the primitive and antiquated tools and appliances are employed and there is very little knowledge of modern appliances for cutting out, sewing, dyeing, &c. Moreover a great obstacle in the way of the leather manufacturer is that if he wishes to turn out good articles, he must use leather tanned and curried either in Calcutta or abroad.

Encouragement desirable.

142. A judicious encouragement of the tanning and leather industries would afford employment to a very large number of Chamars and poorer Musalmans, without the absolute necessity of removing them from villages to congested areas in towns. Shoes and leather articles in common use (*e.g.* irrigation buckets or *mots*) have gone up considerably in price. This has hit the cultivating and middle classes very hard. In well-irrigated districts it is exceedingly desirable that the cultivator should be able

to get a fairly durable leather bucket at a reasonable price. In these days of plague epidemic it is important that the commoner classes should be encouraged in the use of shoes as much as possible. Moreover elaborate and expensive machinery does not seem necessary for a certain degree of improvement in the country industry. I therefore venture to think that the leather industry deserves the encouragement of the Government.

Lines of improvement.

143. The lines of improvement that suggest themselves are—

(1) Small tanning schools to demonstrate improved methods in suitable localities where the supply of hides is large and Chamars as well as Musalmans would be ready to learn, *e.g.* Lucknow, Saharanpur, Gorakhpur.—Once the new processes have been popularized in any centre, the school may be moved to a fresh locality.

(2) Attempts to foster the spirit of co-operation among Chamars and Musalman tanners.—Caste influence is very strong among these communities, and I feel hopeful that if the caste machinery be utilized, it would be possible to introduce industrial co-operation as well. This would enable the tanners not only to obtain raw materials and sell their products on better terms than at present, but also to adopt such improved processes as are beyond the means of an individual Chamar. For instance, some of the vats may belong jointly to a co-operative society. If the co-operative idea takes root in the community, it would perhaps be feasible to give them advances for improved tools in the same way as has been recommended in paragraph 11 above for the hand-loom weavers.

(3) Small schools to teach boot and shoe-making and the manufacture of saddlery and harness with modern tools and appliances.—These schools should be located away from Cawnpore, *e.g.* at Benares, Agra or Meerut, where there are already a large number of workmen, who, I think, would be only too willing to learn improved methods if they are not too expensive. Such schools would also train workmen for the small factories advocated below, and the capitalists and managers of such factories would also be able to acquire the necessary training for their profession.

(4) Small private capitalists should establish factories on a moderate scale—

(*a*) for tanning;

(*b*) for manufacturing leather goods.

Boots and shoes imported from foreign countries are generally of a very poor quality. These provinces have already a considerable reputation in large markets like Calcutta for good durable boots and shoes. During the last few years the demand for country-made shoes of European shape has increased very rapidly. The supply, however, is not equal to the demand as a casual visit to the Calcutta bazars will show. In the circumstances there is a good opening for small capitalists, who would be able to utilise methods and appliances beyond the means of the individual Chamar or *mochi*. I believe there is a growing class of Musalmans as well as Hindus in the province who would be willing to embark in the enterprise, but their chief difficulty now is the want of technical knowledge. At present there is no facility for this class of people to learn the methods of the industry; the demonstration schools recommended in paragraphs (1) and (3) above will supply this want. There is an enormous export of hides from Bundelkhand and also from the Gorakhpur division. A fair supply of tanning materials can be obtained in both these tracts, and there should be no difficulty about water, at any rate in Gorakhpur. Labour is also cheap in these parts. Small tanneries are likely to be successful in these districts.

(5) Introduction of chrome-tanning processes.—The advantages chrome leather has over bark-tanned leather are fully set forth in Mr. Chatterton's paper read at the Calcutta Industrial Conference, 1906.

Chrome tanning.

144. It is now well known that chrome leather is much more durable than bark tanned leather, especially when subjected to frequent immersion in water. Reference has already been made to the fact that the annual renewal of his *mot* or irrigation bucket means a great burden to the cultivator. A chrome leather bucket will probably last twice as long as the ordinary article and the cost of the periodical oiling will also be saved. If it is manufactured on a fair scale, the cost of chrome tanned leather does not exceed that of bark tanned leather by more than 10 per cent. The use of chrome leather buckets will also set free a large number of hides for the manufacture of other kinds of leather articles or for export. Another advantage resulting from the adoption of the chrome processes would be a reduced demand for bark, the supply of which is beginning to fall short of requirements. A chrome tannery does not involve the use of very expensive machinery and the buildings also cost less than in a modern bark tannery. Another point for consideration is that in bark tanning, it

takes quite a year for raw hide to be converted into good leather. In chrome tanning the time occupied is very much less. The amount of capital locked up in the factory is much less, and a quicker turn-over is secured. I would strongly recommend the establishment of small mixed tanneries in different parts of the province. They will combine the processes of bark tanning and chrome tanning. The capital required will not be large. The outturn will always command a sale, and if sufficient supervision can be secured, a branch establishment for the manufacture of boots and shoes can be started along with the tannery. A few such tanneries have already been established in Calcutta, Orissa and South India, and so far as I have been able to ascertain, they are doing well. Adequate instruction in the technical processes is given at the Government Chrome Tannery in Madras. Intending capitalists should also acquire some knowledge of the local markets before starting a factory.

Tanning materials.

145. Reference has been made above to the failing supply of tanning materials. Myrobolans from Bundelkhand, Central India and the Central Provinces are used to a certain extent. The chief tanning agent employed is *babul* bark. Its price at Cawnpore is estimated to have risen over 125 per cent. during the past fifteen years. The consumption of the two large factories at Cawnpore exceeds two hundred thousand maunds per annum. The supply from the neighbourhood of Cawnpore itself is fast running out and high freight charges have to be paid for imports from distant centres. The Cawnpore tanneries are therefore severely handicapped in their competition with more favourably situated factories. To remedy the present state of things it is necessary to encourage the plantation of *babul*, *rhea* and *Cassia auriculata* in the province. *Babul* wood is in great demand for fuel and there is also considerable use of it for cart wheels, railway keys and other purposes. A *babul* plantation does not take very long to grow and is very useful as a protection for embankments. The Government is already trying the cultivation of *babul* in waste lands and ravines in Bundelkhand. Landholders will find it a very profitable investment to sow *babul* on unculturable land. The bark of the *Cassia auriculata* is the principal tanning agent used in Madras, where the indigenous tanning industry flourishes better than in any other part of India, it is an ideal material for the tanning of goat and sheep skins. "The tannage produced is soft, light in weight and colour, and admirably suited to the various requirements of the Home market, being more easy to manipulate than the harder tannages of *babul* and *rhea*."* At present there is no cultivation of this plant in the

* The quotations are from a paper contributed by Mr. A. Shakespear, Secretary, Upper India Chamber of Commerce, to the Naini Tal Industrial Conference.

United Provinces, but experiments conducted here some years ago "proved that the shrub took kindly to any soil. It can be reared at a very small cost and will give a return within three years. The shrub is merely cropped to obtain the bark and is not exterminated as is the case with the *babul* and *rhea* trees."* The *rhea* or *rheunja* tree (*Acacia leucophlœa*) grows wild in the Doab districts and in Jhansi. The bark yields a fair percentage of tannic acid, and although inferior to *babul* bark it is a useful adjunct to the latter. If a regular supply can be arranged, the Cawnpore factories alone will probably consume a large quantity. Experiments have been made with the fibre of *rhea* for the manufacture of wood pulp and a favourable opinion has been expressed by experts in England. No tests on a commercial scale have yet been made. Even without its use as woodpulp, plantations of *rhea* will probably pay on waste land.

Railway rates.

146. A brief allusion may be made to the question of railway rates as they affect the leather industry. Special rates are in force for wagonloads of bark to Cawnpore and Agra, but small quantities of tanning bark even if securely packed are charged second class rates. A reduction of the rates will probably lead to the collection of *babul* bark in localities where small scattered *babul* jungles are to be found. This will widen the source of supply almost immediately. Boots and shoes of European pattern are subject to a higher railway tariff than those of the country pattern. As indicated above, there is a marked tendency nowadays among all classes to wear boots and shoes of European pattern. Such shoes are not much more expensive than native pattern shoes, nor do they take up more truck space. There seems to be no justification for discriminating rates.

Pigskins and Horse hides.

147. Attention may be called to the fact that neither pigskins nor horse hides are at present in any way utilised in the provinces. The ordinary Chamar keeps pigs, but will not tan their skin. Doms have to be employed for skinning horses. It may not be worth the while of any one to collect the few horse hides available in rural tracts, but in large towns like Lucknow, Agra or Meerut there is likely to be an appreciable supply if a demand grows up. Pigskins will probably be found everywhere in large quantities. Industrial missions among the Indian Christian community may care to investigate the subject.

* The quotations are from a paper contributed by Mr. A. Shakespear, Secretary, Upper India Chamber of Commerce, to the Naini Tal Industrial Conference.

Chapter IX.—Oil and Oilseeds.

Linseed, rapeseed and til outturn and consumption.

148. Oilseeds are very important crops in the provinces, and in normal years the outturn has steadily increased as will be evident from the following figures for the three principal crops:—

Crops.	1900-01.	1901-02.	1902-03.	1903-04.	1904-05.	1905-06.
	Mds.	Mds.	Mds.	Mds.	Mds.	Mds.
Linseed	42,25,494	48,04,500	64,59,043	68,17,792	27,51,140	32,97,840
Rapeseed ...	1,08,12,488	1,27,61,603	1,49,41,886	1,56,05,854	93,86,040	1,16,84,400
Til (sesamum) ...	28,23,665	22,72,070	31,47,116	28,48,618	15,34,970	17,06,250

The agricultural conditions were adverse in 1904-05 and 1905-06; hence the diminished outturn. It is hoped the figures of 1903-04 will be reached or exceeded in a good year.

A great part of the produce is of course consumed locally, but the export of oilseed is developing very fast. The comparative figures for linseed, rapeseed, and *til* for the years 1901-02 and 1903-04 are as below:—

Exports in thousand maunds.

	1901-02.	1903-04.
Linseed	232	3,787
Rapeseed	4,130	5,006
Til	790	1,022

For reasons given above, figures for later years have not been taken.

Export trade.

149. As was pointed out by Dr. Voelcker in paragraph 127 of his report, it is not good agricultural economy for any country to export oilseeds. The oil should be expressed from the seed in the country and it alone exported. The oil cake obtained should then be either fed to cattle or applied to the land directly as a manure. True economy lies in the former course,* for in that case not only would the vitality of the work cattle be sustained but the greater part of the nitrogen would still go back to the land.

Some oil is even now exported from the province. Figures are available for mustard and rape oil:—

	Imports in thousand maunds.	*Exports in thousand maunds.*
1901-02	2	22
1903-04	4	59

* See Agricultural Ledger, No. 1 of 1877. Dr. Leather's article on Indian manures.

Prospects of power mills.

151. With increasing pressure on the soil the cultivation of commercial crops, among which oilseeds are to be reckoned, is likely to develop continuously. The number of cattle available in the provinces is limited and it is not desirable that any large proportion of such cattle should be engaged for purposes other than cultivation. It will therefore be an economic advance to substitute some mechanical power in the industry of oil-crushing. For purposes of exporting over long distances it is necessary that the oil should be pressed as in expensivelyas possible. It is true that a certain quantity of hand-crushed oil is nowadays exported over from the eastern districts to Bengal, but the increasing number of modern oil mills in that province is certain to affect this trade. The establishment of small power mills for crushing oil is very much to be desired in districts where the oil area is large. A market for the oil crushed in power mills will be found (*a*) in the large towns of the province, (*b*) in adjacent provinces, (*c*) for export to foreign countries, and (*d*) among manufacturers of other goods like paints, fragrant oils and soap. The chief obstacles towards the development of a power industry are (1) a belief among the consumers of oil that hand-pressed oil is superior and (2) the difficulty of persuading the cattle owners of the province to use mill oilcake. I am of the opinion that the former obstacle will be easily removed by actual experience. In Calcutta mustard oil crushed in mills is now mostly in use, and the three power mills established in Cawnpore, although exporting their mustard oil largely to the Calcutta market, where favourable prices are obtained, have not met with any prejudices among local consumers. As regards the second difficulty, mill-made mustard oilcake sells freely in the Punjab as cattle food. I think useful demonstrations of the suitability of this class of cattle food might be given at the agricultural farms in the province. Moreover public-spirited and enterprising zamindars can do the same on their own home farms. If oil mills (on a small scale at the beginning) be started by influential landholders, there is every reason to anticipate a great commercial success. The same mill would crush linseed, mustard, and *mahua* with slightly different appliances, and the power could also be utilized in slack seasons for milling wheat, hulling rice or to manufacture ice. Two points must be borne in mind by persons intending to start oil mills. The first is that a fairly large working capital is necessary for the seed has to be purchased during a very short season and the oil has often to be kept in stock for a long time before it is sold off. Secondly it is very necessary that the owner should keep a strict watch over his subordinates. Mill oil recommends itself to the public on account of its purity in contrast with the adulterated oils sold in the bazar. It is very easy to mix bad oil with good. I know of

more than one promising concern that came to grief on account of the dishonesty of the underlings in this matter. In a venture like an oil mill it is best to start on a small scale with a mill of a limited capacity and an oil engine. When the local consumers have been taught to appreciate the value of the products turned out by the mill, it should be easy to expand the business. Oil mills are now to be found in many districts. The power mills of Cawnpore (belonging to Indian capitalists) do good business and so does the oil mill at Shohratganj in district Basti belonging to a native firm of Cawnpore. The two mills at Dehra are worked on a comparatively small scale as they suffer from the disadvantage of having to use oilseed imported from down country. I came across other oil mills doing a fair amount of business in Meerut, Gorakhpur and Lucknow. There are large areas under linseed and rapeseed in the districts of Gorakhpur, Basti, Gonda and Bahraich. Oil mills are likely to flourish there owing to the proximity of the markets in Bengal. In Bundelkhand again there are extensive areas under *til*, and I think mills specially designed for crushing *til* will do well in that tract. The oil as well as the cake would probably find a market in Bombay and Western India.

Dhuan.

152. The other principal oilseed products of the provinces are *mahua*, castor, poppy, safflower, *dhuan* and cotton. There does not seem to be any immediate prospect of a large market in the province for oil pressed out of *dhuan* (*Eruca sativa*), or safflower (*Carthamus tinctorius*). Safflower oil is already used to a certain extent for alimental purposes and for burning. Safflower was formerly in great request especially in European countries as a dyestuff, but the colour is fugitive and superior synthetic dyes have trenched on the market of safflower in this respect. Poppy seeds are exported from all the districts where there is much opium cultivation. I think the greater part of it goes to France. The manufacture of poppy oil is an important industry in that country especially in the north. The oil is consumed as a substitute for olive oil. The inferior variety, usually of a red colour, is used for soap making, as lamp oil and as a matrix for colours in oil paint and colour making. I am not aware of any industrial use of poppy oil in this country, but there is likely to be a demand for it with the development of the soap, paint and colour industries. The *mahua* tree (*Bassia latifolia*) is very plentiful in the forests of Mirzapur and Bundelkhand and also in the eastern submontane districts; the seed is exported in large quantities *viâ* the Indian Midland section of the Great Indian Peninsula Railway. *Mahua* oil is used in the province as a lamp oil and is also in great demand for the manufacture of *dhobi's* soap. It is consumed in other provinces for adulterating *ghi*, and there is a large

Safflower.

Poppy.

Mahua.

demand for export purposes. In European countries *mahua* oil is used mostly for the manufacture of soap and candles. The cake, according to Dr. Leather (*Agricultural Ledger* no. 8 of 1897), will probably be found to be a very valuable manure. Even now cattle are largely fed on *mahua* seed, and the cake is probably a better food than the seed. I do not know of any mills in the province pressing *mahua* oil. It is a very promising industry and should be taken up by landholders in the parts of the country where *mahua* trees are so abundant. I shall refer to another economic use of the *mahua* when treating of the lac and varnish industry.

Castor-seed.

153. Figures are not available of the annual outturn of castor seed. In 1903-04 the province imported five thousand maunds of castor seed and exported 117 thousand maunds. Two years later the figures rose to ten and 195 thousand maunds respectively. Traffic figures for castor oil were, on the other hand practically stationary. In 1903-04, 3½ thousand maunds of oil were imported and twenty thousand maunds were exported. In 1905-06 the figures were three thousand and twenty-two thousand respectively. The uses of castor oil for burning and for machinery of all kinds hardly require mention. "The oil cake is not edible, but it forms an excellent manure and this is well known to cultivators in all parts of India." The East Indian Railway has large castor oil mills at Manauri near Allahabad, where over four hundred operatives are employed. The Victoria Oil Mills in Meerut employ about fifty labourers. A castor oil mill was also established at Etawah by native capitalists, but, as in many such ventures, the fluid capital was small and work has had to be stopped. There are several castor oil presses worked by hand power or oil engines in Cawnpore. The oil sells easily in the local bazar, while the cake finds a ready market among the potato cultivators of Farrukhabad, who go in for good manuring. With the increasing use of machinery of all kinds in the province there will be a very rapid development in the consumption of castor oil. The spread of scientific methods of agriculture is also daily augmenting the demand for castor oil cake. In Europe and America, a large quantity of castor oil is used in medicine and there is an extensive consumption for soap-making, in the production of Turkey red oil and leather oil, as a lamp oil and for lubricating purposes. There is consequently a very promising opening for mills in districts where good crops of castor seed are to be obtained.

Cotton seed. Traffic figures.

154. We next come to cotton seeds. The normal area of the cotton crop in this province is one million acres, although during the last two or three years this estimate has been much exceeded. It has been calculated that the produce of *seed* from one million acres would be about 134,000 tons. The seed required for sowing is roughly

5,500. The seed available for consumption in other ways therefore exceeds 128,000 tons. Formerly there was comparatively little export of cotton seed from the provinces, and much of it was used as cattle food. The exports, however, have been rapidly rising in recent years. Separate figures for cotton seed only are not available, but the export under the head "other oilseeds" rose from 344 thousand maunds in 1898-99 to 1,517 thousand maunds in 1905-06, and 1,803 thousand maunds in 1906-07. It may be assumed with reasonable safety that this large increase has been mainly contributed to by cotton seed. The exports go mostly to the Punjab, where a portion is used as cattle food, and the rest, I think, is sent through Karachi to foreign countries. The province is thus losing every year an increasing proportion of the concentrated cattle food available within it.

Cotton oil industry in America.

155. In America cotton seed was formerly treated as a waste product.* The cotton seed oil industry now flourishes in all Western countries and is most prosperous in the United States. "The rise of the cotton seed industry during the past two decades has been a phenomenon among phenomena that have made the United States the *premier* industrial nation of the world. It has dotted the South from the Roanoke to the Rio Grande with 618 separate mills utilising in an intricate and costly manufacturing process what forty years ago was a nuisance that required for its control the enactment of legislation."† In America the seed is usually crushed in crude oil mills situated close to the cotton fields. Very often the ginning and crude oil mills are combined in the same factory. The seed is cleaned and afterwards reginned in order to remove the greater part of the lint that adheres to it after the first ginning. This reginning process is also known as delinting. The seed is then hulled or decorticated. The hulls were at one time used as fuel for the mill but have a good market now as a cattle food and fertiliser. The meat after the hulls have been removed is crushed into a uniform consistency and then cooked or heated. The object of the "cooking" is "to expel the excess of moisture by evaporation, to heat the oil to facilitate the maximum separation and to coagulate the albuminous matter of the seed whereby its solubility in the oil is reduced." The meat is subsequently formed into cakes by gentle pressure. These cakes are then subjected to great pressure by means of a hydraulic press, the products being crude oil and cake. The cakes may be marketed in the same state or after reduction to meal by grinding. In either form it is highly prized as a feeding stuff and a manure. The crude oil is removed

* See Mr. Mollison's paper on the cotton seed oil industry (*Agricultural Ledger* no. 9 of 1903).

† Lamborn—Cotton seed Products (London Archibald Constable, 1904).

rates in force on the different railways, but for oil a comparatively high charge is levied. We therefore have the spectacle of oilseeds from these provinces being pressed into oil in the vicinity of Calcutta where land and labour are much dearer. A reduction in the rates for vegetable oils is urgently necessary. The matter was discussed in detail in a special report already submitted.

Chapter X.—Brass and Copper.

Consumption.

158. Brass and copper utensils are necessities in every Indian household, and gifts of such utensils are usually made on the occasion of weddings and other festivals. Owing to the general prosperity of the people, the use of metal vessels has much increased within the last fifty years and every household owns a larger assortment of such articles than it did formerly. The competition of china, earthenware, enamelled iron, or aluminium has so far affected the trade in brass and copper only to a slight extent and until recently the manufacture of the vessels was practically free from the rivalry of imported or machine-made articles. Formerly, however, the alloys were mixed in the country, and most of the vessels were made of old utensils melted down or of plates cast locally. The supply of old utensils has now fallen short of the enhanced demand, and the industry of local casting and moulding is fast giving place to the manufacture of vessels by beating out imported brass sheets. In copper, imported sheets have always been mostly utilized on account of the very high temperature required for its melting.

Traffic returns.

159. In the traffic returns imported brass sheets are supposed to be shown as unwrought brass, but I think errors are often made by the railway clerks in classification as will be evident from a detailed study of the figures. In the larger bazars of the provinces I have not come across any large imports of wrought brass articles from outside with the exception of railway fittings, etc. For purposes of comparison it is therefore safer to take the figures of wrought and unwrought brass together :—

	Imports in thousand maunds.			*Exports in thousand maunds.*		
	1891-92.	1905-06.	1906-07.	1891-92.	1905-06.	1906-07.
Brass (wrought and unwrought)	69	114	94	55	59	47
Copper (unwrought) ...	56	10	2·5	1	·5	4·3
Copper (wrought) ...	9	11	11	5	4	4

These figures clearly illustrate the very great increase in the use of brass sheets. The exports are almost entirely all manufactured vessels and their weight has remained practically stationary. There is some export by rail from Mirzapur of old brass vessels, which probably go to Europe to be converted into brass sheets. The marked fall

in the import of copper (wrought and unwrought) began two or three years ago and is no doubt due to the very great increase in the price of this metal. On account of its high price copper is being to a certain extent replaced by brass in the manufacture of household utensils; thus the copper vessel industry of Lucknow is not now as large as it used to be about twenty years ago. In Musalman households, where copper vessels were formerly in great request, enamelled iron and earthenware have now begun to find favour.

Distribution of the industry.

160. Nearly every town in the province has a few braziers and coppersmiths as well as shops for the sale of vessels. The distributive supply of metal vessels is also carried on by pedlars who go about from village to village. The industry is, however, to a great extent localized. Mirzapur, Moradabad, Farrukhabad, and Benares are the largest centres of the brass and copper industry in the provinces. In Mirzapur, there is still a good deal of melting, casting and moulding of old brass, and there is a rising industry in the beating out of domestic vessels out of sheet brass. Exports from Mirzapur go to all the towns of the province and also to other provinces. In Benares a section of the industry is devoted to the manufacture of *lotas* of a peculiar shape. Every pilgrim to the holy city buys if he can one of these *lotas*. A very large quantity of domestic utensils is also turned out of old molten stuff and of brass sheets. The art brass of Benares is made entirely out of brass sheets. In Lucknow, copper as well as brass vessels are made in large numbers and a speciality is made of Musalman domestic and ornamental vessels. In Moradabad, besides the artware, there is a vigorous industry in the manufacture of utensils of brass as well as the so-called white metal, and a very large number of workmen are employed on contract wages by middlemen. Farrukhabad is another large centre for the manufacture of vessels suited to Musalman use. The brass industry is also rapidly extending in the towns of Agra and Muttra. Among smaller centres of the industry may be mentioned Bahraich, Hasanpur Bandhwa in the district of Sultanpur and several villages in the Gonda district. In all these places the industry is practically limited to the melting and casting of old metal. Some *phul* brass is also manufactured. In Bahraich there are about fifty families engaged in the trade. They are mostly Thateras, but other castes are also taking up the business. In Khargupur in the district of Gonda, the number of brass-working families is about thirty. Other artisans are to be found in Balrampur, Utraula, Tulsipur and other villages in that district. In these Oudh districts the old metal is imported by dealers (mahajans) from outside or purchased from local pedlars. The dealer makes over the metal to the brazier and takes back the same weight of finished vessels, paying the brazier a contract rate

according to the shape and size of the vessel. The organization of the industry at the brazier's house is the same as will be described below for the Moradabad east brass industry. The brazier usually obtains an advance from the dealer. It is the latter who runs all the risks of fluctuation of prices. The vessels manufactured at these centres are largely exported to neighbouring districts. The work is distinctly good and well finished. The fluted vessels specially are quite handsome in appearance, and the braziers know how to give a very high polish to the articles.

System of work.

161. The various indigenous processes of manufacturing brass and copper wares are described by Mr. Dampier in his monograph on the subject. The artizans are mostly *thateras* or *kaseras*, but a large number of other castes like *Sunar*, *Lohar*, *Bania*, and *Ahir* are also represented. Census statistics are not very reliable as the occupation and caste in the case of metal workers were often erroneously mixed up. In the larger centres of the industry the manufacture is generally in the hands of a number of comparatively wealthy men, who employ workmen in their factories and there is considerable division of labour. The workmen earn between three and eight annas a day according to their skill and the nature of the work. In the smaller towns the industry adapts itself to the family organization, a few skilled and some unskilled labourers on daily or monthly wages being employed in addition. Skilled workmen earn from five to six annas a day while unskilled labourers seldom earn more than three annas daily.

Moradabad cast metal.

162. To illustrate the conditions of labour now prevailing in the industry, the system obtaining at Moradabad, Mirzapur and Farrukhabad may be described. The dealer of moulded brass vessels at Moradabad buys old brass from pedlars and villagers and supplies the same as well as the requisite quantity of zinc to the headman of the actual factory. The following different classes of artisans are to be found in a factory :—

	Average daily wages.
Mould maker	... Six annas.
Mould finisher	... Six annas.
Furnace man	... Eight annas.
Ragrai (cleaner with file)	... Five annas.
Chhilai (turner)	... Eight annas.
Khinchai (assistant to turner)	... Three annas.

The workmen are all Musalmans of various castes and confine themselves to only one branch of the industry. The learners are of all ages; they begin to earn a little after three months' practice and become fully qualified artisans in two years. The factory is usually located in the house of the headman, who also transacts all business with the dealer, but the other workmen can hardly be considered his employés. The dealer

pays piece-wages for the whole work depending on the kind and quality of the vessel manufactured. The amount thus paid is according to the conventions of the industry distributed by the headman in fixed proportions to the different workmen and towards the cost of moulds, fuel and other ingredients. Thus if the dealer pays six annas for every *lota* turned out, it will probably be divided as below :—

Mould maker	...	1½ pice
Mould finisher	...	1½ „
Furnace man	...	4 „
Filer	...	1½ „
Turner	...	4 „
Assistant turner	...	2 „
Earth for mould	...	1 „
Salt, oil, etc.	...	1 „
Fuel for furnace	...	4 „
	Total	20½ pice.

The balance of 3½ pice will meet the price of tools and implements, the cost of repairing vessels that come out defective from the mould or the furnace and the inevitable loss of a small portion of the raw material. (The dealer makes an allowance for the last-mentioned item.) On the whole the cost of labour slightly exceeds the price of the old brass used. After the headman has made over the vessels to the dealer, the latter hands them to the finisher who cleans and burnishes them and has to be paid separately in piece-wages. If the vessel is to be of Monghyr [illegible] the dealer on getting back the yellow brass articles from the [illegible] above gives them to the *kalaigar* who uses tin and [illegible] materials. The processes of the *kalaigar* are very primitive [illegible] tin is exceedingly thin. After the tinning or whitening [illegible] it. His work is occasionally followed by that of the [illegible] and engraver are all paid contract wages according [illegible] quality of the work.

163. There is also a considerable industry in [illegible] domestic utensils out of imported sheet brass. [illegible] of Hindu *thateras*, who work at home on the [illegible] by the large dealers, and contract wages being [illegible] turned out. The *thatera* has to find his [illegible] for flux, etc. Sheet brass vessels are [illegible] being considered more durable. The [illegible]

Large quantities of mill made *katoras* are now imported into Moradabad from Poona and locally converted into white metal.

The Moradabad system of work also prevails at the neighbouring town of Najibabad (in the district of Bijnor) whence large exports of domestic utensils go to Garhwal and Almora.

Moradabad art brass.

164. The factory system is still further developed in the manufacture of Moradabad art brassware. The successive processes are—

(1) cutting the imported brass sheets into small pieces as required ;

(2) hammering the pieces into the shape desired ;

(3) joining the different pieces to form one vessel ;

(4) polishing the brass, partly on a lathe and partly with a sharp chisellike instrument ;

(5) engraving designs. First a general outline is drawn, then the smaller details are filled in ;

(6) lacquering ;

(7) cleaning.

The first three stages are the same as in ordinary sheet brass work and do not require any special skill. The fourth and fifth processes are the most important and demand considerable training. Lads are taught for a year or two without wages and then they begin to earn about four rupees a month. The best engravers earn twenty to twenty-five rupees a month. The work used to be concentrated in a few factories belonging to men of substance who were not themselves workmen. The artisans were paid either daily or piece-wages. Nowadays the artisans dislike being employed as hired labourers and endeavour to set up a business of their own. The capital required is inconsiderable. Sometimes the small manufacturer starts with sheet brass; occasionally he buys readymade vessels from the bazar and then starts polishing and engraving upon it. The demand for the cheaper style of goods has much developed in recent years. Dealers come from outside and make purchases. The larger manufacturers in Moradabad generally sell to their correspondents at the ports and the principal towns. The engraver usually works from imagination or with the aid of his memory. Occasionally an old model or a paper design is utilised. Only in the highest class of goods are any measurements resorted to. The artisans and dealers are recruited from both Hindus and Musalmans.

Mirzapur.

164. In Mirzapur the industry in brass and copper is divided into four branches. The most important department is of course the manufacture of all kinds of domestic

utensils, especially *lotas* from old materials. I was informed that about five hundred maunds of goods of this class were turned out every day. The processes and conditions of the industry are much the same as at Moradabad with the important difference that at Mirzapur the head of the factory is the master of the business. He conducts it with borrowed money as a rule and sells his products to a dealer who exports outside. The difference is not always to the advantage of the factory owner. He has to incur all the risks of the violent fluctuations in prices in the brass and copper market. His resources are limited, and when there is a contraction of demand on account of scarcity or famine, he feels the full force of it. In Moradabad on the other hand the dealer is usually a wealthy man and can wait for the return of a more prosperous season. No white metal work is done in Mirzapur. The second branch of the Mirzapur industry consists of the manufacture of vessels by beating out sheet brass. *Thalis* and *parats* (flat bottomed dishes) as also basins of various sizes are turned out in large quantities. Local dealers import sheet metal from the ports and sell to the manufacturers. The portions required are cut out and then beaten into shape. The rejected chips are sold to the manufacturers of art brassware at Benares. After the vessel has been pieced together, some little ornamentation in the way of indentations is effected also by beating. The finished article is sold to the dealer in the same way as the moulded vessels. The average daily production of this style of articles is estimated at a hundred maunds. A third section of the Mirzapur artisans manufacture various kinds of vessels out of copper sheets. Pitchers or *gagras* form the principal product. Copper *gagras* last much longer than iron ones and when old and broken fetch a fair price unlike an iron vessel which has to be thrown into the scrap heap. Middle class Indian families therefore prefer copper *gagras*. The business in copper vessels has suffered a serious reverse owing to the great rise in the price of the metal, but as a result of the recent fall in price the industry is again reviving. The fourth branch of the metal industry at Mirzapur is the manufacture of vessels made of *phul* or bell metal (an alloy of copper and tin). Brass mixed with tin is melted in a furnace. Small slabs are then beaten into shape, being annealed from time to time in a small furnace with a low fire. About five men are employed on each annealing furnace. The work is arduous. The business is usually in the hands of a capitalist who does not take any part in the actual work. The workmen in the Mirzapur metal industries are mostly Hindus, of all castes. Some of them come to work daily from villages at a little distance from the town. The better class of artisans (like the mould maker or the finisher in the cast metal industry) earn from eight to twelve annas a day, while the

daily wages of the workmen with lesser skill ranges from three to five annas. According to all accounts the industry has not declined in recent years. No dies, presses or stamping machines are yet to be found in Mirzapur. The dealers purchase the finished articles from local manufacturers and export to all parts. Some dealers also go in for a little manufacture on their own account, but this is only very occasionally the case.

Farrukhabad.

165. In Farrukhabad, it is estimated that about twenty-five maunds of cast metal articles are produced every day and about fifty maunds of sheet metal vessels. In the cast metal industry there is not the same system of division of labour as is to be met with at Mirzapur and Moradabad. Thus I came across artisans who manufactured *katoras*, and performed with their own hands or with the aid of one or two assistants all the operations from the making of moulds to the finishing and burnishing. These artisans take old vessels and some new metal from the dealer (Mahajan) and supply all the other ingredients and materials themselves. The Mahajan pays a fixed rate per maund of *katoras* of a certain size. Similarly for other articles. In the sheet metal industry the master artisan or head of the factory gets the raw materials from the Mahajan, pays his own workmen usually at piece rates and obtains payment from the Mahajan for finished articles by the weight. The artisans thus have nothing to do with the fluctuations in the prices of sheet metal. This system approximates to the method of business at Moradabad. The average monthly earnings of a brass worker at Farrukhabad varies from ten to fifteen rupees. The Farrukhabad specialities in sheet brass are *handis*, *parats* and *patelis*. In some *handis* the lower halves are of molten metal, and the upper portions of sheet metal. The brass vessels of Farrukhabad are exported mostly to the hill districts and to the Punjab. Some goods are sent also to the markets at Cawnpore and Allahabad. The manufacture of copper vessels is not carried on at Farrukhabad on as extensive a scale as formerly. The utensils turned out are mostly *degchis*, *handis*, etc. The number of factories has fallen to five or six. The system of business is the same as in the sheet brass industry.

Lock manufacture.

166. In one branch of the brass industry, modern tools and processes have been to a large extent utilized and considerable progress has been made. Aligarh has earned a well-deserved reputation for its excellent locks. The postal workshops* there afford a good training ground and a large number of private factories has now been established. Two of these employ more than two hundred labourers each and one is a joint-stock company. Aligarh manufactures monopolize the market for the

* In 1907, the Aligarh postal workshops employed 371 men daily.

better class of locks all over the province. Good locks are also made at the towns of Hathras and Muttra.

Large works.

167. I am not aware of any brass foundries in the province on a large scale besides those at Aligarh. Some brass work is done by the Empire Engineering Company of Cawnpore and also at the Engineering works at Allahabad and Lucknow. The railway workshops at Lucknow, Jhansi and Gorakhpur of course do a lot of work in brass. A promising enterprise was started in Lucknow a couple of years ago for turning out domestic utensils by machinery, but, as often happens in such cases, the capital raised was too small and the company had to seek the aid of an outside capitalist. The latter became bankrupt; his creditors are now in possession of the works, and will, I am told, start manufacture very soon.

Art brass.

168. The art brass-work of Benares and Moradabad is well known and does not require any detailed description. The conditions of the Moradabad industry have been described above. A good account of the processes employed in the Benares art brass industry will be found in chapter IV of Mr. Dampier's Monograph on brass and copper wares. The three principal varieties are (1) the manufacture of idols and other figures, (2) the engraving of trays, salvers, candlesticks, etc., (3) raised or relief work on trays and other fancy articles. Casting is resorted to for the first kind while sheet brass is used for all articles of the second and third kinds. The system of work is very much the same as at Moradabad. Some of the larger dealers have factories where they employ journeymen artisans on fixed or piece wages. But the great majority of the craftsmen work at home, the dealer supplying them with brass sheets and paying contract wages for the articles turned out. The artistic work of both Benares and Moradabad has considerably deteriorated of late years, and although the volume of the industry is still fairly large, there is great danger of its disappearance unless some improvement takes place.

Brass jewellery.

169. Brass ornaments for women are manufactured more or less in all districts. They do not differ in shape or size from similar ornaments of silver and are often made by men of the *sunar* caste. There is very little art, and the industry is pursued on the domestic system. Solid and hollow brass idols are cast by a few *sunar* families at Srinagar in the Mahoba tahsil of the Hamirpur district. Small brass figures (mostly images of the infant Krishna) are manufactured from moulds in the town of Muttra. The number of workmen is very small. The designs and shapes are conventional and fast deteriorating. At Jaswantnagar in the Etawah district fairly artistic candlesticks are made as also several kinds of brass musical instruments.

Suggestions for art brass.

170. All art brassware is liable to tarnish especially in a damp climate. The art brass of the province suffers moreover from bad shapes, inartistic designs and too crowded work within a small space. There is also often a lamentable lack of finish. The work has degenerated from the want of an artistic standard to rise or aspire to, and from a desire to manufacture cheap articles. The brass figures and images are very inferior in conception and execution to the similar ware of Jaipur. The engraving does not compare favourably with the minute finish of the brass engraving of Madura and other towns in South India. The establishment of a school of art like the Jaipur school at one of the centres of art brass in the province is likely to make a great impression on the industry. It will teach drawing and improved designs to the workmen, and set up a high artistic standard to be followed by the trade generally. It will also introduce new shapes and models. Much can also be done to place the art industry on a firm basis if small factories were started by a few educated men with some knowledge of modern decorative art who would infuse new life into the conventions of the existing art and at the same time appreciate the danger of introducing unsuitable innovations.

At Amroha, in Moradabad district, some very good work used to be done at one time in brass fittings of palankins, *raths*, *ekkas*, chairs and beds of state, etc. A few craftsmen even now turn out very decent articles, but the present demand for this style of goods is very small. The artisans will probably be successful if they took to manufacturing articles of modern demand. Brass mounted occasional tables, brackets, picture frames, etc., in the Amroha style are likely to be very effective. The craftsmen can also perhaps be taught brass inlaying like the Jalandar work.

Metal engraving and electro-metallurgy.

171. Comparatively little work is now done in these provinces in the way of modern metal engraving, *e.g.* the engraving of name plates and monograms, transfer processes, etc., etc. The demand for this style of goods is slowly but steadily increasing. No training is at present available in these arts. The matter might be borne in mind if a metal worker's department is started in any of the technical schools.

The various branches of electro-metallurgy will also give employment to a large number of artisans if they could be properly trained. The consumption of electroplated articles is very much higher than it was twenty years ago, and would be still higher but for the difficulty of replating the articles experienced in all but the largest towns of the provinces. Very handsome and artistic articles are turned out in the electro-plating department of the Jaipur school of arts.

171. Turning to the main branch of the industry or the manufacture of domestic utensils, the improvements that may be found feasible are— **Suggestions fo domestic brass.**

(1) the adoption of modern tools and appliances.—The system of wooden moulds can probably be introduced, which will save great labour where moulding is still practised. Punching machines and improved hand lathes will also make a great difference. Another obvious improvement is the use of dies to stamp the vessels into the required shape. I do not think this device has so far been used anywhere in the province. As mentioned above, die stamped *katoras* and glasses, manufactured in the Deccan and also I think to some extent in Europe, are now finding their way into the province. A leading brass dealer of Moradabad informed me that he was making arrangements to set up a die-press in that town. Apart from power presses many kinds of hand press are used in western countries.

(2) works on a large scale utilising machinery and steam or other power.—The Lucknow metal works have been referred to already.

(3) co-operation amongst the artisans.—I am, however, afraid much cannot be expected from co-operation in this industry. A dealer in brass and copper vessels has generally to keep a very large and varied stock and a co-operative association will find it difficult to make suitable arrangements for this branch of the business. Prices of brass and copper sheets are subject to constant and sudden fluctuations. There is a speculative element in the purchase of these sheets, and it is doubtful whether a co-operative society of artisans will get the raw materal cheaper than at present. Now the dealer finds the capital and undertakes practically all the risk of the business. The artisan is assured of the wages of his labour. The conditions are therefore different from the weaving industry, for instance. There is also a great deal of competition amongst the dealers and profits are cut very fine.

(4) Manufacture of new styles of articles.—In the bazars in the western districts I found large quantities of brass fittings of lamps and tin and brass lamps made at Delhi. The workmanship was fair and the price low. With somewhat improved tools and appliances there is no reason why local braziers or tinsmiths should not make this style of goods. In the year 1906-07, there was an increase of nearly seven lakhs of rupees or

forty per cent. in the imports of lampware into India. Kerosine oil is now being substituted for vegetable illuminants even in the remotest villages. Cheap lamps with glass chimneys to replace the small insanitary and dangerous tin cubes now used will be welcomed by the people.

Railway rates.

172. Before leaving the questions connected with the brass and copper industry, reference may be made to the railway charges levied on this class of goods. The railway freight on broken brassware is high, and at most of the centres of the industry there is a complaint of the scarcity of the material showing that there is very little broken ware gathered up from remote and rural tracts. The rates for finished ware, both art and domestic, will also admit of reduction, and I would suggest the concession of special rates to Benares, Mirzapur, Farrukhabad and Moradabad (for brass sheets and slabs from the ports and for manufactured articles from these towns). A special report has been submitted to Government on the subject.

Chapter XI.—Iron, Steel and Minor Metals.

Consumption.

173. Comparative figures of the consumption of iron and steel afford a fairly correct index of the industrial development of a province. As no iron is produced locally we may take the traffic returns to represent local consumption. Statistics for 1898-99 and 1905-06 are given below :—*

	Imports in thousand maunds.		*Export in thousand maunds.*	
	1898-99.	1905-06.	1898 99.	1905-06.
Cast-iron	106	153	10	16
Unwrought	5	71	3½	6
Wrought	629	892	84	84
Manufactures	133	164	28	63
Total ...	873	1,280	126	169

These figures exclude railway materials. Galvanized and corrugated iron sheets and building materials are included within the head "wrought-iron," while tools and implements, cutlery, trunks, presses, screws, pumps, sewing machines and machinery of all sorts are shown under manufactures. It should be noted that the total consumption has increased by nearly one-half in the short space of seven years. A still more satisfactory feature is that there has been actually a decrease in the net import of manufactures (total imports *minus* exports). This coupled with the great rise in the imports of what may be called raw materials (*e.g.* cast, unwrought, and wrought-iron) shows that more materials are being worked up in the provinces into finished goods than in former years. The rise in the export of manufactures is probably accounted

* The system of classification was altered during the course of the year 1906-07. Figures for that year have not therefore been taken.

for by the supply of municipal appliances to towns outside the provinces from the engineering firms at Cawnpore and Allahabad. Exports under other heads mostly represent through trade. The imports come almost entirely from the seaports except small quantities of cast-iron and manufactures from Bengal (outside Calcutta).

State and railway workshops.

174. As already mentioned, the traffic figures quoted in the last paragraph do not take into account the work conducted at the Railway workshops. The extent of the railway industry may be judged by the number of hands daily employed at the different centres in 1907 :—

Saharanpur.—North-Western Railway Locomotive workshops	349
Bareilly.—Rohilkhand and Kumaun Railway shops	137
Allahabad.—East Indian Railway Carriage and Wagon shops	225
Jhansi.—Great Indian Peninsula workshops	2,676
Gorakhpur.—Bengal and North-Western Railway Carriage and Wagon workshops	1,737
Lucknow.—Oudh and Rohilkhand Railway Locomotive workshops ...	2,826
Oudh and Rohilkhand Railway Carriage and Wagon shops ...	1,561
Rohilkhand and Kumaun Railway shops	404

Besides the above Roorkee has several state workshops—

Canal foundry and workshops	650
Thomason College workshops	165
Sappers and Miners workshops	172

The Aligarh Postal workshops employing 371 men have already been referred to. Besides giving employment to a large number of operatives these semi-public workshops furnish an excellent training ground for men who wish to set up ultimately as blacksmiths using improved tools and appliances. In the Great Indian Peninsula Railway workshops at Jhansi, apprentices are admitted between the ages of fifteen and nineteen and paid an initial wage of four rupees monthly. Men of all castes, Hindu and Musalman, are to be found in the shops, and a newly-entered apprentice will be sent to any department where there is a vacancy irrespective of hereditary predilections. I was told by the authorities that all castes show very nearly equal aptitude in the work. A few of the operatives at Jhansi are from Bombay and there is a sprinkling of Panjabis. The great majority of the workmen belong to these provinces, but only a comparatively small number are Bundelkhandis. The men easily rise to a monthly wage of fifteen rupees. Mistries get twenty rupees a month and eventually rise to eighty or ninety rupees. Similar conditions prevail at the other Railway Workshops in the provinces. Nowhere is there any system of technical instruction combined with or supplementing the practical training at the

shops. The authorities seem to be agreed that it will be an advantage to have literate apprentices with some knowledge of drawing and general acquaintance with tools and machinery. The subject was considered at the Naini Tal Conference and need not be further discussed here.

Modern private works.

175. There is also in the provinces a number of private iron and steel works on a fairly large scale. Mention has already been made of the lock factories in Aligarh. They manufacture iron as well as brass padlocks. In Cawnpore the Empire Engineering Company (managed by Messrs. Gavin, Jones & Co.) employ nearly seven hundred operatives. They turn out all sorts of structural and municipal appliances. The East Indian Foundry (owned by a Musalman capitalist) has rolling mills and gives employment to about one hundred hands. In Allahabad the firm of Messrs. Frizzoni & Co. carry on general engineering work (employing 800 labourers), while Messrs. Luscombo (about 160 operatives) and the North-Western Foundry (about 150 operatives) specialize in furniture and municipal appliances respectively. The Lucknow Iron works (belonging to Mr. Prag Narain Bhargava) employ nearly 250 workmen and do a lot of work for railways and municipalities. Smaller iron foundries are to be found at Agra, Moghal Sarai, Akbarpur in the Fyzabad district and other places. They import pig iron from Calcutta or Barakar and manufacture sugarcane presses, railings, lamp-posts and other miscellaneous articles. The Ganga General mills of Meerut have also an iron foundry department. At Bahramghat (in the Bara Banki district) Mr. Perfect has a very successful sugarcane mill factory. Other factories of the same type exist at one or two other places in the western districts. In all these factories the training of the operatives is the most difficult process, and when a workman has obtained a good grounding he is apt to migrate to other provinces where wages are higher.

The village smith.

176. Turning to the indigenous industry, blacksmiths are to be found in every town and almost all large villages in the provinces. Mr. Dobbs gives a good account* of the village smith who makes plough-shares and other agricultural implements. "The village *lohar* is paid in the old-fashioned way by an allowance of grain . . . . His occupation is purely hereditary; . . . . the artizan usually has his shop and only devotes a fraction of his time to his craft. The ordinary smith is a handy man, and is often the village carpenter as well as smith, and may also be called in for such work as lining a well." Even in the case of the village smith the need of some training is daily becoming imperative. He should be able to repair the iron appliances

* Monograph on iron and steel-ware in the United Provinces by Mr. W. H. J. Dobbs, I.C.S.

presses. The adoption of up-to-date and at the same time inexpensive agricultural implements is hindered by the want of technical knowledge on the part of the smith. If improved hand-looms be generally adopted by village weavers, the smith-carpenter of the locality will have to be a smarter man.

The town blacksmith.

177. In the towns, the blacksmiths turn out a fair quantity of domestic utensils of various kinds, usually working with imported iron sheets of varying thickness. Some bar iron is also utilised, part of which is scrap iron sold by the railways. At Mirzapur iron *gagras* are made in large quantities, as also other vessels like basins, frying and grilling pans, etc. Similar articles are also manufactured on a fair scale at Benares. There is nothing distinctive about these industries and the system of business is the same as in the sheet brass industries in those towns. In Mainpuri also iron sheets are imported and various kinds of vessels like buckets, pitchers, etc., are manufactured and exported into the interior of the district and to neighbouring towns. In Farrukhabad there are about twenty small factories making iron articles. Dealers import the sheets from Calcutta and Bombay and give out work to the factories on the same system as obtains in the brass industry. Among other things iron chests are manufactured at Farrukhabad. The dealers in iron goods are different from the dealers in brass vessels. The dealers generally dispose of the merchandise at the fairs in adjacent districts. Thin iron vessels are manufactured at Najibabad in the Bijnor district for export to Garhwal, but the thicker iron vessels used in the Bijnor district are imported from down country.

Shahjahanpur cutlery.

178. The town of Shahjahanpur has a small industry in locally manufactured cutlery. Old steel and iron in the form of carriage and buffer springs, etc., scrapped by the railways are purchased by dealers at Cawnpore and imported to Shahjahanpur, where the *lohars* buy in small quantities at a time. The *lohars* manufacture knife blades and *sarotas* (betelnut grinders), as also barber's scissors and razors. The *saiqalgar* then burnishes the cutlery and provides handles which are usually of horn and sometimes of bone. The articles are sold locally and dealers often take them to other districts. Considering the very rough implements used, the products have considerable merit and they are very cheap. With better trained skill and the adoption of modern tools a very fair industry could be developed.* At present about twenty families of *lohars* and ten families of *saiqalgars* are engaged in the Shahjahanpur trade.

Meerut scissors.

179. Meerut has considerable reputation for the scissors manufactured in that town. An account of the industry will be found in Mr. Dobbs's monograph on iron

* Pocket knives of a very decent quality manufactured in the district of Bardwan have a large sale all over Bengal.

and steel work. The raw iron is purchased at Calcutta or Delhi. "In a typical shop the following men were found at work: two owners superintending, finishing and packing, etc., two men at the forge, and a boy to work the bellows, one boy for filing the handles, three men for hammering and filing the blades, one man for joining the two portions together. This does not take into account the polisher *(saiqalgar)* who works apart." About twenty factories are to be found in Meerut giving employment to two hundred persons. The operatives are paid piece wages by the owners of the factories. The scissors are almost all meant for tailors' work and sell from four annas a pair upwards. But for the somewhat clumsy joining they can hardly be distinguished from the cheaper imported scissors. Meerut scissors have a great reputation all over the provinces for edge and durability. As in the case of the Shahjahanpur industry the introduction of better tools is the chief desideratum. With more organisation a much larger market can be secured.

Steel trunks.

180. During the last few years blacksmiths and tinsmiths in many localities have taken to the manufacture of despatch boxes and "steel trunks." The despatch boxes (except those turned out by the large factories) are not so good as those manufactured at Delhi or Multan. Useful trunks are made at Allahabad and are found on sale in all the bazars of the provinces. The factories in Allahabad are owned by Musalmans. Soft sheet iron is imported from Calcutta. German and sometimes Aligarh locks are used. The painting is done with aniline dyes. The chief defect is in the corner pieces and the hinges. Here again more technical skill will probably overcome the difficulties. Similar trunks are now made in Benares and Lucknow and I came across some factories in the western districts. There the competition of the Delhi-made article is very severe.

Lines of development. Government patronage.

181. As was mentioned to me by the manager of one of the largest iron works in the province, the best way to encourage the iron and steel industry would be for Government, which is the largest consumer at present, to get as much iron and steel manufactures locally as possible. The firms court competition with firms in other provinces and abroad, but wish that tenders should be called for from them on all possible occasions. Being on the spot and employing the latest machinery they naturally have an advantage over outside firms in the style of goods they produce.

Manufacture of new style of goods.

182. As mentioned in the notes on sugar, there is a very promising opening for private capitalists in the manufacture and supply of good sugarcane mills. Small factories could also be established for making steel trunks, despatch boxes, etc., for

which there is now an expanding market in the provinces. A large quantity of hardware (nails, anvils, axes, files, chains, pegs, tubs, hinges, clasps, etc.) are at present imported from abroad which could be easily manufactured locally by small firms run by energetic and business-like managers. Machinists in England and elsewhere advertise handmachines for the manufacture of wires, wirechains for bed mattresses and similar articles of domestic use. It ought not to be difficult for small factories to set up such machines.

The imports of cheap cutlery, padlocks, tools and lampware from the Continent of Europe are increasing very fast.* A portion at least of such goods can be manufactured in the country in small factories with improved tools and appliances.

The use of cotton umbrellas has rapidly developed within the last twenty years. Most villagers now like to possess an umbrella. In other parts of India the tendency in recent years has been to import umbrella fittings in larger quantities and fewer finished umbrellas. In 1906-07, the imports of umbrellas into India declined by Rs. 93,000 or 4·72 per cent. while there was an increase of Rs. 9·31 lakhs or 44 per cent. in the value of umbrella fittings. It may not be feasible for the engineering works in the province to manufacture umbrella fittings, but the business of manipulating imported fittings for the manufacture of umbrellas is an easy one and can be taken up almost as a domestic industry.

Technical Education.

183. The main difficulty of iron and engineering works in the province, whether large or small, is the want of labour. Schools should be started in two or three centres for the training of blacksmiths. Good blacksmiths are very difficult to get in the province and, although a large number of men are trained in Public Works Department and Railway workshops, not many are available for private work. It is very difficult to get a bicycle, a typewriter, or a sewing machine properly repaired in the smaller towns. Blacksmiths command good wages. If boys were trained from an early age to use good tools and appliances they would be able to set up for themselves and would also be welcomed at the many factories and workshops in the province. The supply of qualified fitters and drivers is not at present equal to the demand. The owners of small mills and factories find it very difficult to get competent men of this type, while large engineering works experience much trouble in retaining the services of their trained men. As soon as a hand begins to be useful he obtains employment elsewhere as a fitter or driver. Some firms have complained of the competition of Government

* See Report on the Maritime Trade of Bengal, 1907-08, page ix.

workshops in this matter.* The point can be easily settled by a mutual conference of the employers of labour at a place.

The question of the training of fitters, drivers and other mechanics was considered at the Naini Tal Conference in August 1907 and need not be discussed here.

184. The bell metal industry is practically a part of the brass industry and does not require separate discussion. The "white metal" work of Moradabad has been referred to above. I have also mentioned tinsmiths' work in connection with the manufacture of lanterns and lamp fittings and of despatch boxes and steel trunks. Some lead work is carried on in Farrukhabad, but the outturn is insignificant. In the course of my visit to that town I could trace only one family manufacturing lead vessels. Sheets and ingots are purchased in the bazar, cut into pieces, melted and poured gradually into earthen moulds. The subsequent processes are practically the same as in the manufacture of brass vessels. The lead articles I saw were of some artistic merit, but the weight of the metal and its price will always be in the way of its adoption for domestic use. The rapid extension of water works and drainage systems in the towns of the province will soon necessitate a fairly large supply of trained plumbers. So far there has been no attempt (except at the Lucknow Metal Works) to manufacture aluminium vessels in this province. An increasing quantity of aluminium ware is now to be seen in the larger bazars in the province. They are usually imported from England or made in Bombay. No caste prejudice exists against aluminium and the superior qualities of the metal are gradually winning the favour of the local public. There is not, however, any prospect of the successful working of aluminium factories in the province unless the supply of raw metal is facilitated by the exploitation of the bauxite mines in the Central Provinces. The high price of brass and especially of copper in recent years has contributed to the growth of the trade in enamalled iron. Its use is becoming common in middle class Musalman and some Hindu households. Provincial figures of the consumption of enamelled iron are not available, but in 1906-07, nearly nineteen lakhs worth were imported into India. I doubt, however, whether it will be possible in the near future to create an industry in the province in the manufacture of enamelled iron articles and compete successfully with the very cheap ware of Austria and Germany, which are now the chief suppliers. In Benares a large number of workmen are employed in German silver. The alloy is imported and the articles turned out include (1) jewellery, (2) household utensils, and (3) engraved and chased work like the art brass of the city. The

Other metals.

Lead.

Aluminium.

Enamelled iron.

German silver.

*See Mr. Prag Narain's paper on the Metal Industry at the Lucknow and Metal Industrial Conference, March 1918.

industry was a very promising one a few years ago, but is now in a stationary condition because the rural patrons of German silver jewellery have now discovered that old German silver is practically valueless. There is, however, still a considerable sale of utensils and art work among pilgrims and visitors, although the designs have suffered in the same way as those of art brass. This it is hoped will be remedied when a school of drawing and design is established in the province. Household utensils made in Germany of an inferior variety of German silver are now to be seen in the bazars. With proper organisation and the use of modern tools and appliances the Benares industry should be capable of capturing the whole market.

Chapter XII.—Stone and Building Materials.

The stone industry.

185. If accurate statistics were available of the consumption of building materials, they would furnish the truest index of the prosperity of the population. Even an approximate estimate cannot, however, be made of the quantity of bricks and tiles annually used in the provinces while stone and lime are lumped together in the traffic returns. In stone, Agra, Mirzapur and Jhansi are the centres of the industry. Some stone quarrying also takes place in the trans-Jumna portion of the Allahabad district. The Mirzapur stone mahal is managed by the Government. The mahal levies a royalty on all stone quarried in the district. The business is in the hands of two or three large and a number of small firms. The old demand for stone sugarcane mills has died out and Mirzapur stone is now mostly used as a material for buildings and drains. A large number of mills or hand *chakkis* is also made in the Mirzapur district and exported by private firms. The industry at Jhansi and Agra is similar in character. At Hardwar stone cups and plates are made locally and sold to pilgrims. Good stone carvers are still to be found in many localities. The temples and buildings in Muttra are well known. One or two fine temples have been recently built at Benares. I saw some excellent work still going on at Khurja in the district of Bulandshahr. In the town of Mirzapur beautiful examples of modern stone carving are to be found in a bathing ghat and an unfinished temple. In Agra I was informed that labour was not difficult to obtain for the extensive restorations executed in recent years in the different historic buildings.

Difficulties of transport.

186. In the old days there was a great deal more water locomotion and the traffic in stones to be used for carving and building was much larger in extent if not in volume. Comparatively little stone is now employed for building purposes by private persons in towns away from the quarry districts. The industry will revive only if there is again a development of the water ways. Railway carriage is too expensive for stone as it is for many other kinds of heavy or bulky goods. The same difficulty was experienced in Germany and other continental countries until the policy was adopted there of utilising the rivers and canals as valuable feeders and adjuncts to the railways. It is possible that the phenomenon will repeat itself in this country.

Inlaid stone work.

186. The inlaid stone work of Agra is one of the smaller art industries of the province. The marble is obtained from Rajputana and valuable stones come from all parts of India and abroad. The industry is naturally in the hands of a very small

number of comparatively wealthy men. There are only a few workmen and there is no regular system of training. The artisans are recruited from all castes, Hindu and Musalman. The goods manufactured are ornaments of various kinds. A tendency is to be observed towards a hybrid art; accidental shapes and models are being introduced, while the design of the inlaid stones itself remains oriental. The result is not always pleasing to the eye. The patrons of the art are mostly American and European tourists. Outside what can be effected by a school of design it is impossible to suggest any practical steps towards the improvement of the art or the condition of the craftsmen.

Stone engraving in Chunar.

187. Chunar in the Mirzapur district has a small industry in stone engraving. Messrs. Thakur & Co. obtain Italian marble from Bombay and Calcutta and manufacture tombstones, cups, plates, etc. No mosaic or figure work is attempted. Chunar stone is also extensively used. One or two smaller firms have also started work in the same style. There is promise of development in the industry.

Lime.

188. Lime is manufactured out of kankar wherever it is available. There is also a considerable import of lime from Katni in the Central Provinces. The industry of burning limestone has recently developed in Dehra and the foot of the Kumaun hills and large quantities of lime are exported to the plains districts. The rate of royalty charged in state forest lands is now under consideration.

Bricks and tiles.

189. The manufacture of bricks is localized in every district at places where good brick earth is available. Patent kilns are as a rule used. There is very little export of brick from one district to another. The tile industry is still more scattered, and with the exception of patent tiles, most in use in Government buildings, practically all tiles are manufactured by the *kumhars* of the town or village. The brick and lime industries now employ a very large number of persons as also does building, but they are all in the hands of small capitalists and there does not appear to be any necessity for Government action. Considering that a great deal of building is now going on in all towns it is very desirable that the opportunity should be taken to diffuse better sanitary and architectural ideas amongst both house owners and professional builders and masons.

Chapter XIII.—Woodwork and Carpentry.

Building materials.

190. Although the furniture industry is gradually assuming large proportions, the principal consumption of timber in the provinces is for railway purposes and for joinery or the fittings and fixtures of houses. For building materials in the villages, with the exception of *sal* rafters used in the better classes of houses, locally grown timber like *nim*, mango, and *shisham* is mostly in demand. The traffic figures which are given below therefore do not afford a correct indication of the volume of the industry:—

	Imports in thousand maunds.		*Exports in thousand maunds.*	
	1901-02.	1905-06.	1901-02.	1905-06.
Unwrought timber	904	725	684	813
Manufactures	60	68	27	124

The unwrought timber comes mostly from the Punjab, Rajputana and Central Provinces to the adjacent parts of this province. The submontane tracts are the chief timber-producing districts in this province and it is satisfactory to observe that in 1905-06 the exports of raw timber exceeded imports. There has been an improvement in manufactures also and the eastern submontane districts now export a large quantity of sawed timber ready for use. Bahramghat has recently come to the front in this industry. Building materials of a superior kind (*e.g.* teak doors and windows) are still to a large extent imported from Bengal and sometimes in a finished state. The large engineering firms do a great deal of woodwork in connection with structural work and conservancy appliances.

Furniture making.

191. Furniture is now made in almost every town. Bareilly is the largest centre. In the smaller towns no stocks are kept by the dealers and as the number of carpenters capable of turning out any decent articles of furniture is limited it takes a very long time to get orders executed. In the larger towns as at Bareilly there are a few dealers who keep a stock of new and second-hand furniture.

Cart and coach building.

192. Amongst the other branches of wood work practised in the provinces is the construction of bullock-carts and *ekkas*. Pilibhit has a large trade in *rehlus* or light bullock wagons. The building of the *raths* used in the western districts demands a great

deal of skill, and occasionally very handsome *raths* are to be seen. Ordinary bullock-carts can be set up by any village carpenter. Coachbuilding is one of the rising industries of the provinces. *Tumtums* and *ekkas* are built in almost every town. In the bigger cities like Lucknow, Meerut, Agra and Allahabad, several large firms, European and Indian, are engaged in the business. In Meerut, the industry has made considerable progress in recent years. There are now about fifteen factories. The timber is obtained locally or imported from the submontane districts. Wood for the shafts is often brought out from Europe and Australia. Some country leather is used but for the better class of carriages, leather is imported from Calcutta or Bombay. Iron and brass fittings are to a large extent made locally. Axles, springs, bicycle wheels, etc., are as a rule imported. In Meerut, all the carpenters and leather workers employed at the factories are local men and give satisfaction to the owners. They are paid good wages, varying from ten to twenty rupees a month. In Lucknow I was informed by a prominent coachbuilder that he has to employ Punjabi carpenters on high wages (a rupee a day or more) because the local workmen take no pride in their work and do not display any aptitude to learn new methods.

Turnery and lacquer work.

193. A certain amount of turning work is done in a good many places in the provinces. Pilibhit exports a large number of turned bed-posts. Gorakhpur is another large centre. In many other places, *e.g.* at Amroha, in Moradabad, a speciality is made of turning *dholaks* (*tom-toms*). Wooden dishes and toys of various kinds are also turned in several centres. Mention should specially be made of the lacquered toys and ornaments manufactured at Benares and the neighbourhood.

Carpenters and caste.

194. All the above branches of woodwork are in the hands of carpenters or *barhais*. I have not attempted any estimate of the number of men engaged in the profession because in many western districts even in the towns, a *barhai* often does the work of a smith and many *lohars* by caste are carpenters by trade. As pointed out by Mr. Dobbs in the monograph on Iron and Steel Work, the village smith is also very often the village carpenter. In the eastern districts I have often come across wood turning being done by men other than *barhais*. The wood carving in Saharanpur and Nagina (which will be described below) is mainly in the hands of Musalman artisans. On the other hand a *barhai* carpenter will turn his hand to any branch of the profession and there is no distinction in the trade between joinery, cabinet making, upholstery or polishing, and very few artisans specialise in any of these

branches.* Except in the large engineering works I have not seen any machinery used. It must, however, be noted that the sawyer is usually a Musalman and altogether a different man from the carpenter. The contractors who purchase timber in the forests often get it sawed locally. The usual practice, however, is to send down logs to the large centres like Bareilly, where the dealer sometimes gets it sawed into boards before sale.

315. The system of work at Bareilly will illustrate the conditions prevailing in the industry in other large centres as well. The timber most in request is *shisham*; some *tun* is also used. *Sal* or *haldu* is not employed at all in Bareilly. Consignments of teakwood are obtained by the better class of factories from Calcutta. Large dealers take contracts in state forests in the tarai and have the trees there felled with local labour. The logs are railed from Lalkua and Mailani to Bareilly, where they are kept in stock in depôts belonging to the dealers. Furniture dealers and carpenters who have their own workshops purchase the timber they require from these depôts, employ Musalman sawyers and then utilise the wood. As regards other materials and fittings, spirit varnish is largely consumed and some use is also made of lac. The iron fittings, *e.g.* hinges, screws and nuts are generally imported. The brass fittings are to a certain extent manufactured locally, as imported brass articles are rather expensive. The locks used are either European, Aligarh-made or local. I was told that the cheaper locks are better made locally than if imported from foreign countries. Cane for chairs is imported by dealers from the tarai jungles. *Newar* and cotton tape are manufactured in Bareilly. Canvas, cretonne and similar materials for upholstery are purchased locally from dealers in cotton goods.

The Bareilly industry.

It is estimated that the number of carpenters engaged in the trade nowadays at Bareilly exceeds fifteen hundred. The vast majority are *barhais* by caste, but I came across a few Kayasths, Kurmis and Dhimars. There is not a single Musalman carpenter in Bareilly. *Barhai* carpenters told me they did not mind other castes coming in as there was room for all. One of the largest dealers expressed the opinion that it would be a good thing if Musalmans and other castes took up the profession in larger numbers for the number of the operatives was not too large for the present volume of the business and intelligent youths of all castes displayed fair aptitude for the work. There are not more than twenty carpenters in Bareilly

* The system of production is quite different in Europe. Taking the separate trade of cabinet making only machinery is utilised for a considerable proportion of the work, and there is great sub-division of labour amongst the artisans. Some shops will specialise in carcasework or articles like sideboards and chests. Others manufacture only chairs, sofas, etc. A carcase-maker has no knowledge of chair work, and a chair-maker never goes in for building a bookcase.

who work entirely at their own risk, from the purchase of materials to the sale to a customer. The system most in vogue is that of work in a factory owned by a dealer who is not himself a carpenter. The number of such dealers approaches a hundred; only eight or ten are big houses. Some dealers employ over a hundred carpenters in their shops. In other factories the number of operatives does not exceed ten. These dealers (Hindu and Musalman) have no personal knowledge of carpenters' work, nor do they seem to have any inclination to master the technical portion of the trade. There is every year some accession to the number of dealers, but owing to the want of practical knowledge, many ventures come to grief. The dealers purchase the materials and employ the sawyer. The carpenter working in a factory as a rule gets piece wages and the earnings vary from four to twenty rupees a month. The average wages may be reckoned as twelve rupees a month. The journeyman carpenter is usually an improvident person and generally has an advance of a few rupees from the factory owner. A good carpenter often rises to a fairly independent position. He takes orders for goods in bulk, say thirty chairs or forty door leaves, from a dealer, and obtains an advance of two or three hundred rupees. The carpenter purchases the materials, employs his own artisans and makes over the finished articles to the dealer, settling accounts at the end of every month. There is no regular or definite system of instruction. A boy joins his father's or a neighbour's shop and gradually picks up a little knowledge until he is considered worthy of some wages. As to sales, there is no system of catalogues or prices current. Orders come to the dealers from all parts of the provinces and the larger firms obtain orders from the native states. The prices of Bareilly furniture have much risen of late owing to (1) an increase in the price of timber, (2) a rise in the wages of carpenters and (3) accentuated demand. The goods turned out at Bareilly are as a rule of very inferior design although substantial in shape. The dealers as well as the artisans are absolutely ignorant of drawing. The knowledge of veneering, staining and polishing does not exist at all. The varnishing is very crude and badly done. Furniture is often sent out unvarnished owing to the higher tariff imposed by the railways on varnished furniture. All these defects could be easily remedied.

Development of the furniture industry.

196. I am inclined to think that the furniture industry could be largely developed. There is a growing demand for moderately priced furniture among the upper and middle classes of Indians. The raw material is available in the provinces and there is no reason why any furniture except perhaps the most expensive varieties need be imported from Calcutta or abroad.

It is, however, very difficult at present to get good seasoned timber. The Bareilly dealers complain that they cannot get properly seasoned *shisham* wood, and in the eastern districts I have heard the same complaint with regard to *sal* wood. The matter deserves the immediate attention of dealers in timber. It is also possible that timber other than *shisham* and *tun* suitable for various articles of furniture is available in the Government forests. No easily accessible information is on record on this point. I may mention here that the North-West Soap Factory at Meerut finds it economical to import the wood for the soap boxes from Europe. This seems extraordinary considering that Meerut is not so very far from the forests where enormous quantities of soft wood suitable for packing cases is available. Among the other defects of the furniture industry are (1) a lack of knowledge of the indispensable technical processes like veneering, staining and polishing; (2) the very inferior designs now followed and the utter ignorance of drawing; as a consequence the construction of an article of a new style involves great loss of material; (3) a general want of finish in the articles; *e.g.* the hinges, locks, joints and gluework are sometimes exceedingly defective; (4) the absence of advertising or of a proper organisation for sale and prompt execution of orders. In the preliminary edition of these notes it was suggested that a school of carpentry should be established at Bareilly. This proposal has been accepted. I hope the school will include courses of instruction in joinery as well as cabinet making and the subsidiary processes of veneering, staining and polishing will not be overlooked. Drawing and designs should of course be taught. The school should admit men of castes other than *barhais* because as mentioned above there is room in the trade for other castes and also because it is very desirable that future dealers and factory owners should have a thorough knowledge themselves of the technical part of the business. Otherwise improvements will never come. The other suggestions are—

(1) Increased Government patronage of—
   (a) local carpenters as far as possible;
   (b) otherwise those of big centres like Bareilly.

(2) Establishment of factories started by men of the educated middle classes run with business honesty.

(3) Advertisements and market-pushing on the part of the small firms. A lesson might be learnt in this respect from the numerous firms of Bow Bazar in Calcutta and of Dinapur in Bengal.

(4) Occasional exhibitions of furniture at divisional headquarters. This would be very useful to the local carpenters for new ideas and designs.

Comb manufacture.

197. An industry in wood that has not been mentioned above is comb making. Wooden combs are made in many places all over the provinces and sell amongst the poorest classes being cheaper than imported combs or locally made combs of horn. The work does not require any skill and the commonest woods are employed. In Nagina (Bijnor district), a considerable quantity of ebony wood combs are made. These are more expensive especially as there is some carving in the frame. In the Kumaun Tarai *haldu* wood is largely utilised for the manufacture of combs. Traders from Pilibhit and Delhi purchase from the Forest department hollow *haldu* trees in the Dogari and Sarda ranges. The sound portions of the trunk and branch wood are used for comb making. The wood is either exported in blocks to Pilibhit or Delhi where the combs are ultimately manufactured or the combs are made in the rough in the forest and the cutting of the teeth is done at the centres of sale. Work in the forest goes on from December to the end of March. No carpenters are taken to the spot by the contractors who utilise local labour to do the rougher work. From inquiries made I gathered that carpenters refuse to go to the Tarai except on prohibitive wages and the contractors find it easier to spread the work of cutting out the teeth over a whole year at Pilibhit or Delhi instead of getting it completed within the short working season in the Tarai.

Wood carving.

198. Wood-carving* still flourishes in a few localities. In almost all the Oudh districts one or two carpenters are found who can carve doors in the old style, but there is not much demand for their art. In Shikarpur and Bulandshahr the industry was fostered by Mr. Growse, but is now in a decadent condition. At Barla in Aligarh beautifully executed *shisham* mantel-pieces of Indian design are carved, but practically all the workmen are the servants of a private gentleman and the outturn is very slow and small. In Farrukhabad there are a few artisans and I saw some carved panels of great merit. Efforts have been made by European officers in several places to encourage the industry, but with the change in the style of buildings and fixtures, the old style of wood carving has now a very limited patronage in the Indian community. The industry is at present of economic importance only at Nagina in the Bijnor district and at Saharanpur. In the former town the material chiefly used is ebony. Some *shisham* and sandalwood carving is also done. The ebony wood was at one time obtained from the tarai forests in the neighbourhood, but the quality of the local ebony is inferior and supplies are now obtained from the forests along the course of the Vindhya range. Panjabi traders bring the wood from there in logs and sell at Nagina

Nagina ebony carving.

* See Mr. Maffey's monograph on *Wood-carving*.

at four to six rupees per maund. The purchase of the wood is a somewhat speculative business for faults in the grain are often discovered inside a log which is to all appearances quite sound outside. Carving work proper is now done in five or six shops. The majority of the workmen employed at these shops are the sons or relations of the owner. Artisans who do not belong to the family earn wages varying from ten to twenty rupees. Nearly all the carvers are Musalmans, but there is no hard-and-fast restriction about caste. There is no division of labour and the same artisan has to do all the branches of the work like sawing the wood into planks and boards, joinery, designing, carving and inlaying. The artisans receive no regular instruction in drawing and design, but some of the best carvers possess books of tracings of designs executed in former years. A boy learner is first set to marking circular points in the wood. Afterwards he chisels out the marked portions of a pattern, leaving the real pattern in relief. In the last stage he practises designing in pencil on the wood (not on paper) and subsequently begins to carve. All designs start with squares and rectangles and curves are made to fit into the squares. No system of clay-modelling is resorted to as in European countries and there is no attempt to copy in wood samples of stone-carving. The articles turned out are usually of European shape, *e.g.* tables, boxes, chests, screens, panels, etc. The inlaying of ivory is sometimes done in a very effective manner. In addition to the real carving a good deal of commoner work is done at Nagina. Combs, pen boxes, sticks, jewel boxes and similar articles are turned out in large numbers embellished with a little bit of carving. The business pays well and about two hundred men are employed in this trade.

199. In Saharanpur, carving in the old style of *shisham* doors, balconies, brackets, etc., is in the hands of a few Hindu carpenters. The demand for this style of goods is falling off and the carvers also do ordinary joiners' and carpenter's work. Very good carving can, however, be still turned out if the artisans are given sufficient time and latitude. During the last three decades, a prosperous industry has been developed in Saharanpur in the manufacture of nicknacks and articles *de luxe* in a soft carved wood. The white *dudhi* wood was the material most used formerly, but *tun* is preferred now on account of its colour. It is quite as easy to work with as *dudhi* and does not get stained so quickly. *Shisham* is a much harder wood for carving and *shisham* articles in Saharanpur cost about a quarter as much again as *tun* goods. There are three or four large factories employing fifteen to twenty men each, but most of the wood carvers in this style (who are practically all Musalmans) prefer to work in their own homes. They buy the raw materials themselves and sell the finished articles to the dealers who

Saharanpur carving.

come round and export the goods to various parts of the country. The average earnings of a Saharanpur wood carver amounts to fifteen rupees a month. This is not very much considering that wages in Saharanpur are very high owing to its proximity to the Punjab. The articles turned out are screens, panels, brackets, small tables, photo-frames, lamp-stands and similar goods of occidental use. All the work including joinery is done by the carvers themselves, and as at Nagina the pure carpenter's portion of the work is often unsatisfactory. The patterns of the carving are kept in zinc sheets which are placed over the wood in order to get a tracing in pencil on it. The fretwork machine (which is locally manufactured and costs about thirty rupees) is freely used for the cheaper articles like photo-frames which are turned out in large numbers of the same pattern. After the machine has done its part, the artisan carves with his own hand and then polishes the wood with sand-paper. The designs are stereotyped and very little attempt is made to introduce new patterns. Two or three men in Saharanpur can emboss brass and copper on wood in the way of flowers and foliage. The effect is very pretty and this branch of the industry can easily be largely developed.

Improvements in the carving industry.

200. The great desideratum of the industries at Nagina and Saharanpur is the teaching of the principles of drawing and design. The artisans at present have no idea of designing on paper or in clay or plaster models; consequently there is a great disinclination to attempt a fresh design in wood. If a separate school cannot be established at Nagina or Saharanpur, artisans from there should be attracted by the grant of liberal stipends to the central school of design of the provinces. Another suggestion is that the carvers should either learn ordinary carpentry or confine themselves to the pure carving work and place the cabinet maker's part of the work in the hands of a professional carpenter. The goods will then have a better finish and last much longer. Occasional exhibitions at different centres where the artisans will have an opportunity of studying other styles of work are also likely to do good to the industry. Co-operative purchase of raw materials and sale of finished goods may also be of some service, especially to the Saharanpur trade, but I am not very sanguine about the results. The operatives belong to different castes among the Musalmans, and no communal spirit is to be observed at present. A co-operative association of sale, if conducted on sound lines, is likely to be of value in bringing customers who wish to possess true specimens of the industry in direct touch with the producers.

Mainpuri Tarkashi.

201. Mainpuri has a small industry in the inlaying of brass wire in wood locally known as *tarkashi*. *Shisham* is the only wood employed and is purchased locally

by the artisans. The articles chiefly turned out are *kharaons* (clogs or sandals for the feet), pen-holders, small boxes of various shapes, trays, plates, and photo-frames of different kinds. There are about twenty artisans in the town engaged in the trade. They are all *barhais* who are identical in this district with *lohars*. The artisan buys chips or scraps of sheet brass and cuts out a thin ribbon-like strip to form the wire. Stars are made of loops of this ribbon. The carpenter does all the work himself with a few simple tools. The wood is often carved in a pretty and effective manner before the wire or stars are inlaid. Where the inlaying is of a new or intricate design, the surface of the wood is previously marked in pencil. The artisan then makes a fine incision in the wood with a sharp chisel and hammers the wire in. Curves are rendered very well and if the work is done carefully the result is as a rule excellent. The chief drawback is that the work is necessarily very slow and the articles are costly. Moreover the brass tarnishes after a time and owing to its being inlaid in wood it cannot be polished in the same manner as ordinary brass articles. Some easy methods of preventing the tarnishing of the brass would considerably increase the sale of Mainpuri tarkashi articles. To maintain a high standard in the industry, a good workman is employed under the supervision of the district officer of Mainpuri and is allowed to manufacture articles of real merit. There is usually not much difficulty in selling the goods thus turned out. Considering the very limited nature of the industry I am unable to suggest any better means of raising the artistic standard. The ordinary workmen in the town sell their wares to two or three dealers who have shops in the bazar. I am afraid there is no room for co-operation in this industry.

Picture mounting and framing.

202. An industry which has not yet been properly cultivated in the provinces is that of mounting and framing pictures. With the altering conditions of life in the country and the spread of general culture amongst the people, pictures for the adornment of domestic and other buildings are likely to be much more common than they are now. The business of picture framing has been specialized in western countries. Already there is a demand in the larger towns of the provinces for this kind of work. It is a trade likely to suit an educated young man with artistic perceptions. He should have a knowledge of suitable woods and be thoroughly acquainted with the processes of gilding, polishing and enamelling. It will not be difficult for an enterprising young man to train his own labour.

203. Another industry to which attention may be drawn is bamboo and basket work. Large supplies of bamboo are available in all the submontane districts and in many plains districts. It is of course extensively used at present as a building

material and also for mat-making. In Jhansi for instance about a hundred families of Barars are engaged in the industry of manufacturing mats, baskets and winnows out of bamboos imported from Lalitpur. In many districts chairs, sofas, couches and small tables are manufactured of bamboos and locally available reeds. The industry is however everywhere in the hands of the lowest local castes, Doms, Bansphors, etc. With the very rude tools at their disposal, and considering that they receive no regular training, they turn out excellent articles. But the demand is much larger than the supply. Moreover it is an industry where improved tools and better methods of work (specially in binding and glueing) can be easily introduced. There is practically no limit to the improvements that can be effected in the shape, design and variety of articles turned out.* It is an industry which will not require much machinery or a large working capital. I have very little doubt that a properly organized business will be almost immediately profitable.

Expenses of transport.

204. The question of the expenses of transport is very important in all industries treated of in this chapter. The system of river transport has practically disappeared. Railway freights are at present very heavy for all classes of furniture. A separate note has been submitted to the Government regarding the rates of transport by rail. The improvement of communications by water is too large a question to be dealt with here.

*See two little shilling handbooks on *Bamboo work* and *Basket work* published by Messrs. Cassell & Co.; also the articles in the excellent periodical *work* published by the same firm.

Chapter XIV.—Pottery.

Common domestic pottery.

205. Common red earthen vessels for the domestic use of the poorer classes are manufactured in every village and town in the provinces by resident *kumhars*. They also make roofing tiles and more often than not (at least in the villages) combine agriculture with the trade of the potter. Owing to the brittleness of the products it would be impossible to localize the industry, and any changes in this direction would also disorganize the ordinary village system. There are about half a million potters in the provinces, but a great part of their time, especially in the rainy season, is devoted to agriculture. Two kinds of clay are utilized, known in the vernacular as *kali mitti* (black clay) and *pili mitti* (yellow clay). They are always obtained locally. The different kinds of vessels made and the processes are described by Mr. Dobbs in great detail in his *Monograph on the Pottery and Glass Industries* (1895). I am not aware of any improvements that can be effected in the methods of the village potters.

Coloured and glazed Pottery.

206. Coloured and glazed pottery is manufactured in a few districts, but the outturn everywhere is small. The chief articles made are toys, *huqqas*, *chilams*, *rakabis* and *handis*. Lucknow is the chief centre, but the industry is also carried on in Fyzabad, Agra, Bareilly and Meerut. Technological research is required to find out whether any improvements which could be easily adopted by the trade are possible in the processes of colouring and glazing. The raw materials needed for this class of pottery are very inexpensive and the price of the goods practically represents only the labour of the artisans.* From inquiries made at the various centres it seemed that cheap credit was not one of the requisites of the industry. Metal vessels are with the growing prosperity of the people encroaching on the extent of the trade in pottery, but the customs of the country will for a long time prevent the extinction of the industry. Coloured and glazed pottery is used to a very large extent at the time of festivals and religious ceremonies. Thus the guests at a wedding festival are fed on earthen vessels, and the sweets sent out as presents on similar occasions are as a rule packed in coloured earthen pots. The sale is consequently very local in character and articles are often made in large quantities to order. Otherwise the *kumhar* plies a busy trade at the religious and other fairs in his locality. The difficulties of transport stand in the way of exploiting markets in distant places except for a small and easily packed article like the *chilam*.

* See the calculations in pages 19 and 20 of Mr. Dobbs's Monograph.

Art Pottery.

207. The chief centres of the art pottery of the province are (1) Chunar (Mirzapur), (2) Nizamabad (Azamgarh), (3) Lucknow, (4) Bahadurgarh (Meerut), (5) Khurja (Bulandshahr), (6) Amroha (Moradabad), (7) Rampur, (8) Biswan in Sitapur and (9) Utraula in Gonda.

Chunar.

In Chunar about twenty families of *kumhars* are engaged in the ordinary domestic pottery industry. There is nothing remarkable in the methods of their work. Six families of *kumhars* manufacture the art pottery, the glazing and colouring work being done by five firms of *bhattidars*, two of whom are Musalmans, one is a *khattri* and two are *kumhars*. The potter usually receives an advance in money from a *bhattidar* and supplies the latter with articles according to order. The *bhattidar* sells locally to dealers who come from outside or exports himself to Lucknow, Allahabad, Calcutta or Bombay. The potter procures his clay from tanks about two miles from the town. The earth is thoroughly pounded and softened and all impurities are carefully removed before it is placed on the wheel. In Chunar the wheel is always of local stone and costs about two rupees. Most of the roundish articles turned out at Chunar are fashioned on the wheel; moulds are also used to a small extent. Cowdung cakes are used as fuel in the *awán* or the ordinary kiln of the *kumhar* for common ware. The uncoloured vessels are made over to the *bhattidar* who colours and glazes them at his own factory. The ordinary dark terracotta is produced with the powder of a local red stone known as *ser*. Metallic glazes are used. The artificers were unwilling to mention all the different ingredients utilized by them. The *bhattidar's* kiln is much superior to that of the potter, and one man in Chunar (Jaikishan Das) has devoted considerable attention to this point. Wood fuel is used in the *bhattidar's* kiln. The style of the dark brown Chunar pottery is too well known to need description. The articles turned out are mostly ornamental in character, but in one shop I noticed useful articles (*e.g.* basins and washstand crockery) of a fair quality, which ought to have a large sale if properly advertised. I was informed that the artisans of Chunar could turn out pottery of the Khurja or Nizamabad style, but there was no demand for that class of goods from Chunar.

Nizamabad.

208. The pottery of Nizamabad in the district of Azamgarh is a brown or black ware picked out with designs in white. The number of potters here also is very small and a large proportion of them are engaged in the manufacture of ordinary domestic vessels. The black or brown colour is imparted by a smoking process * and the ornamentation in white lines is effected with silver foil or more commonly with an amalgam of mercury and tin let into the vessels before they are placed in the kiln. The

* Mr. Dobbs's Monograph, p. 12.

effect is rather pretty. The articles turned out are *huqqas* and *chilams*, tea sets and vases, plates and *surahis* or goblets. They are hawked about by pedlars in all the eastern districts at very reasonable prices and so far as I have been able to ascertain have a very good sale. The Nizamabad art is neither high nor pure, but the ware is good enough both for use and for decoration in middle class homes.

Lucknow.

209. The art pottery of Lucknow has been divided into four classes. The variety that has the largest sale consists of the unglazed but coloured articles of domestic use amongst Indians, like *chilams* and cups, goblets and plates. This class of goods has already been referred to in paragraph 206 above. The ware that is most seen on railway platforms and at shops outside Lucknow are (1) varnished trays and vases, coloured in a brilliant style and often painted with the representation of a mosque or one of the public buildings of Lucknow; (2) models of fruits and vegetables; and (3) the well-known Lucknow figures. The last two kinds are made by *kasgars* as well as by a small number of Thakurs, while the other kinds of vessels, glazed or unglazed, are manufactured entirely by *kasgars*. The sale of the models and the figures is gradually increasing with the result that there has been a very remarkable depreciation in the quality of the art. Good specimens are still available if a special order is given and an adequate price is offered. The *kasgars* live in different parts of the city of Lucknow and I was unable to form an estimate of their numbers. They sell their ware wholesale to dealers in the bazar. There is considerable competition amongst the dealers themselves and I think the *kasgars* manage to get a fair remuneration for their labours. There is no necessity for cheap credit for the workmen and the introduction of any improved system of sale does not seem feasible.

Khurja an Bahadurgarh.

210. The pottery of Khurja in Bulandshahr, of Bahadurgarh in Meerut and of the native state of Rampur is practically the same in style. The ordinary red colour of the pottery is covered with a white enamel and is then painted in dark blue and turquoise. Other colours are also to be met with, specially green, claret and terracotta. In Khurja about fifteen families of Musalman *kumhars* manufacture coloured but unglazed pottery, the chief articles turned out being *chilams*, common cups and saucers, plates and ornamented *handis*. There is no difficulty about the sale of this style of pottery. Only three or four families (all Musalmans) manufacture art pottery. The articles produced by them include vases, brackets, flower-pots, and floor tiles. The tiles I saw were very nicely baked and prettily coloured. The vases are sometimes of enormous size and the potter has to resort to special contrivances to fashion them on the wheel. The potter

obtains *kali mitti* from a particular tank in the neighbourhood of the town. As at Chunar it is carefully cleaned of all grit and made into a dough before use on the wheel. Practically no moulds are used at Khurja. Everything is modelled with the hand with the aid of a few potsherds. The glaze is given almost entirely with *kanch* or ordinary glass, and metallic substances. The painting and the figures are done by *kamángars* imported from Delhi and Meerut. I was told that the same system of the painting being entrusted to *kamángars* obtains at Multan and Hala. Firewood is used in the kilns at Khurja. The artisans told me they had no difficulty in obtaining raw materials and the principal question is about sale. Some ware is taken to the different fairs in the division and European gentlemen occasionally send orders. Since the closing of Messrs. Tellery's shop at Delhi there has been very little export to Europe.

Amroha.

211. In Amroha (Moradabad) the potters are Hindus, some calling themselves Thakurs. Most of them manufacture only ordinary domestic utensils. The industry of art pottery is practised by only six or seven families. Local clay is used. Moulds are employed for figures, brackets, etc., while cups, glasses, vases and similar articles are shaped by hand on the wheel. Lac is freely used for colouring. Metallic glazes are employed but the potters are unwilling to give out their processes. The designs of the articles I saw in stock were with a few exceptions very crude and the colouring was bizarre. The special excellence of the Amroha pottery is its thinness. The brittle nature of the vessels makes them very difficult to pack, consequently the market is circumscribed. The potters take their ware to neighbouring fairs like those at Kashipur and Meerut. There are no shops or agencies at Moradabad or Delhi. I was told that an art potter easily earned fifteen rupees a month. The number of ordinary potters at Amroha must be about two hundred. They earn from seven to eight rupees a month.

Biswan and Utraula.

212. The pottery industry at Biswan in Sitapur and at Utraula in Gonda has a very limited output. The articles mostly manufactured are *gharras, handis,* flower-pots and other large vessels. The ornamentation consists of the painting of flowers and foliage on a dark green ground. The painting work is done by *kamángars* with considerable skill and the style is distinctly oriental. The number of *kamángars* in both places is very small. The distance of the villages from the headquarters of the district prevents the ware from being known more extensively than it is now.

Lines of development.

213. Considering the very small number of artisans engaged in the manufacture of superior pottery at each centre, it is very difficult to suggest any methods of

improvement for the industry. The need for technological research for the glazes and colours has already been referred to and an expert may be able to suggest better or more economical kilns. There is further the question of improvement in the designs. Much has been done in this direction at the Jaipur School of Arts. Although training there is free I did not see a single pupil from these provinces in the pottery section at Jaipur. Unless the provincial school of designs is provided with a fully-equipped pottery department, some promising pupils may be sent with stipends to Jaipur by rotation from the different centres of our industry. Sale-rooms at different large centres like Lucknow, Agra, Allahabad and Benares, conducted under the supervision of the Government or of local bodies, are likely to place the producer in more direct touch with discriminating customers. Most of the art pottery is now produced in out-of-the-way places and persons desirous of securing good specimens do not know how to get them. A reduction of railway freights is also necessary to secure more extended markets for the outturn. Complaints on this point can be heard at every centre of the industry in these provinces. That the complaints are well-founded is evident from the fact that the Amroha potters take their wares to the fair at Meerut by bullock-cart instead of by rail.

214. Provincial figures for the consumption of earthenware and porcelain are not available, but there is a growing taste in this direction among the higher and upper middle classes of Indians and there is also a large market among the Europeans and Anglo-Indians. The import figures for the whole of India are interesting :—

	Imports in thousand rupees			
	1901-02.	1902-03.	[illegible]	[illegible]
Earthenware and porcelain, excluding piping ...	25,99,	25,60,	[illegible]	[illegible]

A factory turning out earthenware at moderate prices would find a good market.

But no occurrence of *kaolin* (china clay) has so far been reported in these provinces. The nearest places where the material may be found are Manbhum (on the grand chord line of the East Indian Railway) and Barabhum (on the East Indian Railway in Bengal), Kulgadia (in the Rewah state), and Kusumpur and other places near the Kutab Minar in Delhi. Regular prospecting is however necessary before the prospects can be judged. If the deposits near the Kutab Minar are found to be extensive it is possible to place the industry at Khurja on a firmer basis. Two porcelain factories have in recent years been started in Delhi.

from the Manbhum district and from the Sonthal parganas. I have been informed that both these firms are doing good business. It has also been suggested that the *usar* clay of the province could be used for " firing boxes " if not for earthenware. Technological inquiry is required on the point. Good firebricks are now made in Jubbulpore, and the glass factories of this province have obtained their requirements from there.

Chapter XV.—Glass.

Indigenous Industry.

215. The indigenous glass industry of the province has been divided by Mr. Dobbs* into four branches: (1) manufacture of crude glass or *kanch;* (2) manufacture of glass bangles or *churis* from the crude glass; (3) manufacture of flasks, inkpots, etc., blown or moulded from crude glass; (4) manufacture of lamp chimneys, vases, etc., from broken imported glass.

Crude glass Kanch.

216. Crude glass is mostly manufactured in the Doab between Meerut and Etawah, where *reh* is plentiful, and to a smaller extent in Fyzabad and Rae Bareli, where cheap fuel is obtainable in the *bahul* and *dhak* jungles. Firozabad in the Agra district is the principal centre of this industry as well as of the manufacture of bangles. The factories are usually situated in the heart of the *usar* tracts. The manufacturer is generally a Musalman† who employs hired labour, also mostly Musalman. The work is arduous and many artisans have their eyes affected after a long course of work. The wages are between four and six annas daily. The kilns and different processes are clearly explained in the excellent monograph of Mr. Dobbs.‡ *Reh* from the *usar* lands is the material chiefly used. It is a substance of uncertain composition, consisting of varying proportions of the carbonates, sulphates and chloride of sodium with a large admixture of clay and sand. There are several methods of treating the *reh*, but its variable constituents render the results always uncertain. Nitre and sandstone are also utilised, especially to manufacture greenish glass. The furnaces differ a great deal in size. The smaller ones, with a capacity of fifty to a hundred maunds, are used only for making coloured glass, *e.g.* a rich blue. The commonest size holds eight hundred maunds while a furnace with a capacity of two thousand maunds is not unknown. The furnaces are constructed of sun-dried bricks, the cost of building varying from ten to fifty rupees. The same furnace serves two meltings and sometimes three. The fuel at present used consists of dried leaves, *arhar*, *bajra* and indigo stalk. The cost of manufacture of crude glass in a year of normal prices is about a rupee a maund. It sells at Re. 1-2-0 to Re. 1-4-0 a maund. The total quantity of this glass manufactured in these provinces has been roughly estimated

* Monograph on *Pottery and Glass manufacture.*

† The chief man at Sarai Sishgaran, the principal centre in the Etawah district, is a Brahman.

‡ I am also much indebted to Mr. B. M. Mukerji, Demonstrator in Physics, Roorkee Thomason College, for a considerable information and many suggestions with regard to this chapter.

at two hundred thousand maunds. Its consumption is almost entirely limited to the manufacture of bangles, but a fair quantity is also used for locally manufactured blown glass.

Suggestions for crude glass making.

217. The chief difficulty of the industry in its present condition lies in the furnace. It is constructed only for wood fuel which is growing more expensive every year. Sometimes the supply of fuel fails in the middle of a "melting." It will be a great advantage if the furnace could be so altered, *e.g.* by the provision of gratings, as to permit the use of coal as a supplementary fuel. It may also be possible by improved methods of regulating the passage of air to raise the temperature of the furnace and thus reduce the time occupied in each melting. The glass now turned out from these furnaces is partially opaque. This is attributed to the quality of the *reh* and may also be due to the long time occupied in the melting process. So far as I am aware no regular examination or analysis of the *reh** used in indigenous glass manufacture or of the finished product has ever been made. Technological research is desirable on this point. It may be feasible to mix sand with the *reh* and manufacture a superior variety of glass. The small capitalists now engaged in the industry are well-to-do men and are anxious to adopt improved methods even if they involve larger capital expenditure. They realise that a better class of glass will have a readier market and command a higher price than the *churi* glass now manufactured by them.

Bangle making.

218. The most important branch of the indigenous industry is the manufacture of bangles. The home of this trade is also in the Doab districts from Meerut in the north to Etawah and Mainpuri in the south, but smaller quantities are also manufactured in other localities, *e.g.* at Saharanpur, Budaun, Sultanpur and Ghazipur. As in the crude glass industry, the business is usually carried on by a small capitalist who calls himself a *shishgar*, *churihar* or *manihar*, while the workmen are paid piece wages. The better class of workmen earn from ten to fifteen rupees a month. A few of the most skilful operatives earn thirty to forty rupees a month. As in other trades boys have to learn for some-time without wages. It is believed that nearly five hundred furnaces for bangle making are to be found within a fifty miles radius of Firozabad in the Agra district, and quite ten thousand operatives are employed in the industry. The processes of the bangle makers are described in full by Mr. Dobbs. The furnaces have four to fourteen "stalls" each. An artisan works at each stall aided by a boy assistant. In the manufacture of the inferior kinds of *churi*, there is

* *Reh* has been analysed for other purposes, notably by Dr. Leather (see Agricultural Ledger : *passim*).

very little division of labour, but the work is divided up where the more ornamental bangles are made. For instance at a furnace at Saharanpur I found one man melting the crude glass and placing inside it the coloured strips for ornamentation. A second operative then elongated the glass and cut it into small bits. A third man rounded these pieces and shaped them on a cone-like wooden block. The larger furnaces melt all kinds of glass, while the smaller ones are fit for work with glass of low melting points. Formerly only indigenous glass was used for bangle making, but in recent years there were large imports of block glass (in the shape of pressed salt cellars) from Belgium and other European countries. The imported article was dearer, but was preferred on account of its superiority. *Churi* glass manufactured at the Rajpur and Ambala factories, which has a lower melting point than imported crude glass, has to a great extent ousted the foreign article from the Firozabad market. The Rajpur factory has recently stopped work. The production of Ambala is estimated at about twenty-five thousand maunds a year. The bangle makers also use to a small extent broken glass like soda-water bottles. For ornamentation, the glass chiefly used is imported from the district round Canton in China. It comes in the shape of (1) an easily fusible white opaque glass, something like the white enamel of the flint glass makers of Europe; (2) a transparent ruby glass, greenish yellow in colour, but turning red on heating; and (3) a bright spangled gold coloured opaque glass, looking very much like the gold stone of Central India. The price of the Chinese glass varies from twenty to forty rupees a maund, whereas the block glass of Indian factories sells from five to ten rupees a maund. The consumption of the Chinese glass for decorative purposes is steadily increasing. No attempt appears to have been made to produce this style of glass in India. The matter deserves the attention of factory owners. The retail trade in bangles is in the hands of dealers who purchase from the manufacturers and export the stock to all large towns in the provinces and also to Calcutta and other ports. Some towns like Saharanpur and Jasrana in Mainpuri have a considerable reputation for the ornamented *churis*.

219. The furnace of the bangle-maker like that of the glass manufacturer will admit of many improvements at a perhaps inconsiderable cost. So far as I know, wood fuel is at present used in all bangle making furnaces. They should be so modified as to be able to burn coal, which is now in the Doab districts a cheaper fuel than wood. It may also be possible with some modifications in the arrangements for the regulation of air to produce a higher temperature in the bangle maker's furnace thus permitting the use of glass of high melting point which is as a rule cheaper than

easily fusible glass. The proper regulation of air may lead to an economy in the consumption of fuel. There is also a considerable strain imposed on the efficiency of the furnaces by the present system of work. They are worked for twelve to twenty-four hours at a stretch with the same batch of operatives and then closed for twenty-four hours. The heating of the furnaces costs a great deal, and the frequent changes in temperature damage the furnace. A system of shifts of eight to ten hours each could easily be introduced and the furnace worked continuously. I saw an arrangement of this sort actually in force at Saharanpur and Nagina. The furnaces in use are as a rule lacking in annealing arrangements, and this improvement could be effected without much trouble. There is no attempt to regulate the heat in the furnaces in accordance with the kind of glass being melted. Sometimes several varieties of glass are worked simultaneously at different stalls in the same furnace. This is in all probability false economy. The bangle-makers are receptive of new ideas. They have introduced many new forms and colours in the industry. I think they will be glad to adopt structural modifications in the furnace and improved methods of working if they were told what to do by an expert. The whole subject requires considerable experimental work and research. I do not think much can be done by way of co-operation in the bangle industry. The great point is the manufacture of articles which will be able to compete with imported bangles in price and attractiveness. There is no question of durability in glass bangles. The dealers at present roam all over the country and any regular system of market pushing or travelling on the part of the manufacturers does not seem called for.

Country blown glass manufacture.

220. The manufacture of blown and moulded articles out of country glass, *e.g.* flasks for pilgrims to carry Ganges water, is centred at Najibabad and Nagina in Bijnor. There are also small factories in the districts of Aligarh and Saharanpur. In Benares and Lucknow old broken imported glass (chiefly purchased from the railways) is remelted and blown into jars, lamp chimneys, vases and phials. In Benares there is a small industry in the manufacture of *tiklis* (glass patches worn on the forehead by Hindu women). Small factories also exist at Dehra Dun, Saharanpur and Meerut for the manufacture of lamp chimneys, glasses etc. from old broken glass. The furnaces in Nagina and Najibabad are very similar to the bangle-maker's furnace, but have an annealing oven for each stall. The small furnaces at Dehra and Meerut possess only one annealing oven. In the Bijnor district there are now eighteen factories at Nagina, two at Najibabad, five or six at Kiratpur, a village eight miles from Najibabad and a few at Dhampur. The factories at Nagina are worked on a semi-co-operative basis.

Each furnace has seven stalls; the artisan at each stall works on his own. Fuel is supplied jointly. Other materials and the products are separate. The Musalman artisans refuse to teach men of other castes. No bangles are manufactured at these factories. The crude glass is generally imported from Sikandra Rao in the Aligarh district and costs a little more than two rupees per maund at Nagina. The block glass of Rajpur or Ambala or from foreign countries is not found fusible at a sufficiently low temperature. Some old broken glass from the railways is also utilised. The finished products consist of bottles of various sizes, used for keeping oil and drugs, and also phials and inkstands. Some of the workmen have rough wooden moulds. I was told at Nagina that the number of glass-blowing factories is slowly rising. This is due to the very much increasing consumption of glass articles in the country. Local manufacturers can now compete only with the lowest grades of imported goods. The products of Nagina find their way to all parts of India. The glass-blowers of Nagina and Najibabad have considerable skill, and many of them have been employed at Ambala and Rajpur. Some of the artisans turn out excellent articles in view of the primitive furnace at which they work.

Suggestions fo blown glass.

221. In the blown glass industry also the improvement of the furnace is the principal requirement. If a proper direct firing furnace could be devised costing not more than one or two thousand rupees it will be a great boon to all branches of the indigenous glass industry of North India. Some of the richer *sishgars* can easily spend this amount on a good furnace, while the poorer men can combine to own a furnace as they already do at Nagina. I believe in Japan small furnaces are the rule and there also the blower usually works with glass manufactured at a different factory. With an improved furnace our indigenous artisans will learn to utilise superior materials and to work at a higher temperature. The very difficult problem of the supply of skilled labour for large modern factories may also be solved in this manner. In the Nagina glass blowing industry there seems to be room for the practice of more extended co-operation both in the purchase of materials and the sale of finished goods. The individual *sishgars* who do not possess factories are now very indigent and utterly unable to hold their own against the dealers who buy their ware. The cost of transport of raw materials as well as of the outturn is a very important matter in the glass industry. It will be referred to below.

Imports of glass-ware.

222. The consumption of imported glassware is daily increasing. Beads and false pearls for which there is a very great demand in this province are now entirely imported from Austria, France, Germany and Italy. Every Hindu married woman

wears glass bangles. Those imported from Austria and to a small extent from China and Germany are so superior to the indigenous article in finish and appearance that only the very poorest classes now wear the latter. With a rise in the standard of comfort and an increase in the purchasing power of agricultural commodities the sales of lampware, mirrors, window glass, table glass, etc., are going up by leaps and bounds. The provincial traffic returns do not show glassware under a separate head, but the following statistics relating to the whole of India will be found useful :—

	Imports in thousand rupees.		
	1901-02.	1903-04.	1905-06.
Beads and false pearls	13,53,	19,46,	17,21,
Common bottles	5,28,	6,42,	6,23,
Sheet and plate	12,85,	9,80,	16,51,
Bangles	*	*	38,76,
Lampware	*	*	5,51,
Other ware	62,23,	62,72,	27,07,

* Prior to 1905-06 bangles and lampware were classed under other ware.

Modern glass factories in north India.

223. It will therefore be readily seen that there is a very promising opening in the country for well-managed glass factories utilising raw materials locally available. Factories had been started at Titagarh in Bengal and Ahmedabad in Bombay some years ago but did not succeed. It is not necessary to discuss here the causes of their failure. Indian capitalists started a factory at Umballa in 1895 and obtained the services of an expert from Austria. The first venture was not successful on account of—

(1) the want of sufficient fluid capital;

(2) inexperience of the requirements of the Indian climate regarding furnaces;

(3) the difficulty of glass-blowing in the plains in the hot weather;

(4) difficulty in training skilled labour locally.

The factory is now in the hands of a Punjabi capitalist, who has restricted operations for the present to the manufacture of *churi* glass only. I believe it is under its existing management doing well and the proprietor has built an additional furnace. He hopes to manufacture higher grade glass as soon as the *churi* glass business is firmly established and some glass-blowers are trained locally. A factory on a larger scale was

working at Rajpur near Dehra the last five or six years. The nominal capital was two and a half lahks, of which a lakh and three-quarters had been paid up. About half the shares are owned by Indians. It has three furnaces; *churi* glass was the principal commodity manufactured; but chimneys, tumblers, glasses, etc., were also made on a fairly large scale. The products of the factory were quite decent in appearance and were cheaper than imported articles. The Rajpur factory had naturally very heavy preliminary expenses to incur in the first few years, but on the results of 1906 it declared a dividend of 4 per cent. Since then the want of working capital seriously crippled the business and the business management had also unusual difficulties. The factory stopped work in the rains of this year (1908) and I hear it is likely to change hands. A small factory was started with native capital at Sikandra Rao in Aligarh but suffered from the beginning from (1) the want of fluid capital, (2) difficulties about raw materials and (3) the lack of technical knowledge on the part of the management. This factory was closed within a few months of its inception. A factory with one furnace is now being built at Firozabad by some Hindu capitalists and the Gwalior State is constructing a glass factory at Morar. A few enterprising residents of Dehra Dun are anxious to establish a factory at Doiwala, a railway station on the Song river in the valley of the Dun, but are handicapped for the want of a skilled engineer to build the furnace. I have also seen the prospectus issued by a syndicate of capitalists belonging to these provinces for the establishment of a glass factory in the district of Manbhum in Bengal, where coal and quartz sand are available at cheap rates and labour is not very dear.

Difficulties of modern factories.

224. The furnaces built at the modern factories in North India are not quite up to date from the scientific point of view. None of them use water gas. The furnaces originally constructed at Ambala and Rajpur by the Austrian expert, Mr. Kalus, are designed for the use of gas produced by the destructive distillation of coal. The other furnaces are all meant for direct firing with coal. These direct firing furnaces cost much less to build than a gas furnace, but consume about twice the amount of coal required by the latter. The cost of manufacture is therefore larger and comparatively low temperatures only can be secured. Thus the range of manufactures is also limited. It is however possible that with the low technical skill of the labour now available in the country direct firing furnaces are better suited to our circumstances than those of the most modern type. Apart from coal, the chief ingredients of glass manufacture are sand, lime, alkalis and colouring materials. All the factories in Northern India have hitherto used quartz sand obtained from the vicinity of the cantonments in Dehra Dun. Sand from other sources

has been tried but without success. I have been told that quartz sand can be obtained in the river beds in Agra and its neighbourhood. Limestone also is now obtained entirely from Dehra and burnt at the factories. The alkali used up to date in the factories has been sodium bicarbonate imported from England. With the exception of charcoal, which is utilised for amber glass pigment, all the colouring materials are also obtained from Europe. As regards labour, Austrian workmen had to be imported for Ambala as well as Rajpur and some Japanese artisans have also been employed from time to time. The glass-blowers of Nagina proved fairly apt pupils, but through a mistaken notion of their importance often gave almost as much trouble as the indentured artisans from Europe. Another great difficulty in the way of the factories has been the want of higher technical experience. All the factories have had serious initial trouble in this respect and the furnaces have as a rule cost much more to build than they should have done. Even now there is, so far as I know, no one in the country with sufficient experience in building an up-to-date furnace.

Suggestions for modern factories.

225. It is evident that the establishment of a large modern glass factory in North India is beset with many difficulties. A preliminary technical survey is necessary in order to indicate to intending capitalists what are the best quarries in or near the provinces for sand and limestone. It is also desirable to ascertain whether the *reh* which is used by the indigenous glass manufacturers could by any possibility be used in modern works either for silica or for alkali. These researches can only be carried out by technological experts under State patronage. With regard to alkalis I shall discuss in a following chapter the question of the local manufacture of caustic soda and sodium bicarbonate. The factories will probably find salt cake (Sodium sulphate) an economical substitute for sodium bicarbonate. It can perhaps be cheaply manufactured in India from common salt, the by-product being sold as bleaching powder, hydrochloric acid or ferric chloride, all substances for which there is a good demand in this country. With the development of the mining and metal industries such as that of manganese it should be possible to manufacture in this country at least a portion of the colouring ingredients of glass. In discussing the improvements possible in the indigenous glass industry I have stated that a better furnace for the manufacture of country glass is likely to raise the skill of the artisans who will then be qualified to fill positions in the modern factories. Moreover, a very fair class of artisans could probably be obtained by regularly apprenticing at the large glass works youths trained at the technical classes in Roorkee. Although the Rajpur factory has been closed, I think the Ambala factory may be willing to employ a few such apprentices.

With regard to technical management, my own opinion is that capitalists will find it true economy to obtain a thoroughly competent man from Europe to build furnaces as well as to work a factory. Indian youths with scientific training should be apprenticed at such a factory and when they have acquired a thorough knowledge of local conditions should be sent to centres of glass manufacture in foreign countries to study the systems in vogue there.

Cost of transport.

226. As mentioned in a previous paragraph the cost of transport of the raw materials and of the finished articles is one of the chief problems in the glass industry. I think I am right in stating that a very large quantity of crude glass is brought to this country as ballast in vessels coming from Antwerp and other continental ports. Inland factories in Europe also employ water carriage to a very large extent, especially over the Rhine. Glass is thus landed at a much less cost at Calcutta or Bombay by continental shippers than can be done by factories in North India. The subject was discussed at length in a separate note submitted to the Government and is too technical for treatment here.

Chapter XVI.—Alkalis and Chemicals.

Chief alkali products.

227. The chief alkaline products of these provinces are*—

(1) saltpetre;

(2) *sajji mati;*

(3) refining at Ramnagar of borax imported across the frontier from Tibet; the commercial name of this borax is tincal.

I have been told that in recent years there has been a considerable falling off in the volume of this industry, but have not been able to verify the information.

(4) Glauber's salt or sodium sulphate, known as *khari namak.*—This substance is derived from *reh* either by solar evaporation or by artificial heat, the process being similar to that for the manufacture of crude saltpetre. The chief industrial use at present is in the preservation of hides for export. The *khari* of Behar is said to be purer and is consequently in greater demand. As the export of hides is continuously increasing, it is desirable that a technical expert should enquire whether any improvements are possible in the local methods of manufacturing *khari namak.* It was mentioned in the chapter on glass that sodium sulphate could be substituted for sodium bicarbonate in the manufacture of glass by modern methods. If technological research succeeds in separating a commercially pure sodium sulphate from *reh,* it will be a great advantage to the glass industry.

(5) Limestone at the foot of the Himalayas.—Lime is required for buildings, bleaching powder (*e.g.*, in paper mills), calico printing, tanning, soap and candle works, etc. The development of the glass industry is also likely to lead to an increased consumption of lime. As mentioned above the Dehra Dun and Kumaun quarries are being worked now.

(6) *Kankar,* used for roadmaking and manufacture of lime.—Block *kankar* found in some districts (*e.g.* Jaunpur) is useful for pitching round bridges, piers, &c. Ordinary *kankar* is to be found in most plains districts. In some places like Meerut, power is now utilised for the pulverisation of the *kankar* and the manufacture of lime out of it.

* See paper by Sir George Watt, *Agricultural Ledger,* No. 5 of 1902.

(7) Gypsum (calcium sulphate).—Its industrial uses are (1) to neutralize injurious alkalis, *e.g. reh*, and (2) for plaster of Paris. Deposits of gypsum have been reported in Dehra Dun, Kumaun and Garhwal, but I do not think so far there has been any regular prospecting. The Commissioner of Allahabad told me that a deposit of gypsum had recently been found in the Hamirpur district.

Saltpetre.

228. Saltpetre is manufactured mostly from the nitrous soils in the neighbourhood of old inhabited sites. The methods of manufacture will be found fully described in the publications noted below.* In the villages nitrous earth is scraped together and placed in a filter of straw and brushwood over which water is poured gently. The liquor thus obtained is boiled. The product is crude saltpetre mixed with common salt and other impurities. The owners of the refineries purchase this crude saltpetre to manufacture out of it commercial saltpetre for export. In these refineries, some mother liquor is first of all formed by boiling old nitrous earth in water. The common salt deposited in this liquor is removed. Crude saltpetre is then mixed with the mother liquor, a sufficient quantity of water is added from time to time and the whole mixture is boiled. The scum, which consists of saltpetre earth and common salt, is scraped out. The remaining liqour is then run into vats and allowed to cool and crystallise. The bye-product, common salt, is sold after the payment of duty, while the saltpetre is exported to Calcutta, whence it is sent out of the country mainly for the manufacture of gunpowder. The principal centres of the saltpetre industry in these provinces are in the Agra division. It is also carried on in the eastern districts bordering on the Ganges. The largest number of factories is to be found in Farrukhabad and Muttra. The crude saltpetre is manufactured by all classes of villagers, but in the east, men of the Lunia caste are chiefly engaged in it. The refineries are as a rule owned by Hindus who employ hired labour. I have not been able to estimate the number of

from Calcutta. Very little saltpetre is now used in the country as a fertiliser owing to its high cost in comparison with oilcakes.* An investigation into the processes of manufacture was made by the Agricultural department, but no practical measures for improvement were found feasible.† I am unable to make any suggestions with regard to this industry.

Sajji.

229. The extraction from the usar lands of *sajji* or *sajji mati* (a crude carbonate of soda largely mixed with sulphate of soda) is a fairly important industry in the eastern districts and is gradually extending to the western districts. "The alkali is scraped off the ground and the salts dissolved out from the soil and recovered by evaporation."‡ Exact figures of outturn are not available, but I think the exports to Calcutta and Bengal exceed five lakhs of rupees in value. In the eastern districts the manufacture of *sajji* is in the hands of Lunias, who pay a royalty to the owner of the land. A fair quantity of *sajji* is used in the provinces in the manufacture of country washing soap. So far as I am aware this is the principal use of the stuff in Bengal also.

Alkali manufacture.

230. The question of the manufacture of caustic soda out of *reh* or of *sajji* has often been raised, but has never been properly investigated. The Lucknow paper mills for a time made soda out of *reh*, but gave up the attempt when the supply of *reh* in the immediate neighbourhood of the factory failed. Moreover the paper mills had no trained chemist, nor did they import requisite appliances. No unfavourable conclusion can therefore be drawn from their failure. Messrs. Brunner Mond & Co. sent a representative a few years ago to examine the alkali lands of the province, but took no further steps. As this firm has at present practically a monopoly of the supply of caustic soda and other soda compounds in Northern India their inaction is not to be wondered at. Caustic soda is now required for all chemical industries. It is also in use in the manufacture of soap and paper, in refining oils, in spinning and weaving mills, and in leather tanning and dyeing—all growing industries in this province. Large stocks of caustic soda will be also required to extract aluminium from the deposits in the peninsula and Burma.§ If the glass industry is to be developed, large quantities of sodium bicarbonate or sulphate are likely to be wanted. Supplies of pure sodium sulphate are also required for the hide exporting business. In the circumstances an effort should be made to manufacture the alkalis locally. The Government may either direct researches to be made

* See proceedings of the Board of Agriculture in India, 1907, page 52.
† See annual report of the Imperial Department of Agriculture, 1904–05.
‡ Mr. Moreland's paper on Reh, *Agricultural Ledger*, no. 13 of 1901.
§ See *Records of the Geological Survey of India*, volume XXXII, part I, 1905.

Other chemical works.

Prospects of the chemical industry.

sulphur can be obtained locally, sulphuric acid may be manufactured from sulphur imported from Sicily or Java. Messrs. Waldie & Co. manufacture sulphuric acid at Konnagar in Bengal. Sulphuric acid is now also being manufactured by the Bengal Chemical and Pharmaceutical Works in Calcutta. The last-named factory has been established with Indian capital and is entirely managed by science graduates of Calcutta. In Bombay also there are one or two firms manufacturing drugs and chemicals out of raw materials locally obtainable. It is to be hoped that similar enterprise will be displayed by the graduates in science of the Allahabad University.

Chapter XVII.—Dairy Produce.

Manufacture of ghi.

233. The manufacture of *ghi* is an important industry in the Meerut, Agra and Allahabad divisions and especially in Rohilkhand, where it is one of the main occupations of the agriculturists. The country process of making *ghi* is to boil the milk as it comes from the cow or buffalo. The butter is then churned by churning. It is then clarified over a fire with the water evaporated and the curd is precipitated below. Nearly all cultivators and farmers keep cows and buffaloes, but the industry is mainly in the hands of Banias who go from village to village all over the province. Buffalo milk is considered superior to cow milk for the manufacture of *ghi*. Dealers purchase the *ghi* from the Meerut district and sell it in the Imperial Game and also export out of the province. A great deal of adulteration is practised by unscrupulous dealers, especially with animal fats.

Traffic in ghi.

234. The Provincial traffic figures for *ghi* were as below in 1905-06:—

	Exports in Provincial vessels.	Imports in Provincial vessels.
Meerut	65	5
Agra	99	11
Allahabad	22	5
Fyzabad and Gorakhpur ...	21	15
Rohilkhand and Kumaun ...	7	8
Oudh	11	2
Total ...	225	46
Value ...	37½ lakhs.	16 lakhs.

The imports come mostly from Rajputana and Central India, while the bulk of the exports go to Bengal and Calcutta and a small quantity to Bombay, Punjab and Karachi.

These figures do not include the traffic from one division to another in the province.

Prospects of the ghi industry.

235. It will be seen that Rohilkhand and Oudh produce hardly sufficient *ghi* for their own needs. The question in these tracts is mainly one of cattle-breeding and grazing.* Perhaps something may be done by co-operation between the Agricultural, Veterinary, and Forest departments, especially in the newly opened out parts of

* See papers by Mr. Hadow on Cattle of Bahraich, Kheri and Muttra, *Agricultural Reporter*, nos. 17 and 19 of 1903. Also proceedings of the Board of Agriculture in India, 1903, page 222.

Kheri. The processes of *ghi* manufacture in Bundelkhand were investigated by the Deputy Director of Agriculture a few years ago. I understood from him that his inquiries had reference mainly to the cleanliness of the methods employed. He found the average quality of Bundelkhand *ghi* was good and the indigenous methods were clean, but at the time he was not in a position to make any experiments to ascertain whether the *quantity* could be increased by improved processes. The sales are at present effected through the agency of middlemen, and it is probable that production would be cheapened and better prices obtained if large creameries were started and the small manufacturers adopted co-operative methods. Further inquiry by agricultural experts is desirable on these points. Even with the indigenous processes it is probable that a small capitalist manufacturing good *ghi* will earn decent profits by selling it in the towns where pure and wholesome *ghi* is now very difficult to obtain.

Modern dairy methods.

236. The adoption of modern dairy methods is likely to enhance considerably the profits of such a business. "In *ghi* making (by the country process) we get only two products, *viz. ghi* and *mattha* (or buttermilk) which is of a low value for sale. According to the improved European methods the cream which the separator takes out of the milk contains all the *ghi* and the separated milk contains all that is required for drinking purposes and for use in making curds and cheeses and also sweetmeats. The cream being only about a twelfth part of the whole not only reduces the labour in dealing with it, but reduces the cost of fuel in making the *ghi*. The milk being taken away reduces the curd in the *ghi* and thus improves the quality. Under the ordinary system it is difficult to manage any quantity of milk in the hot season, but by means of the separator the difficulties are at once overcome; the cream being taken away from the milk as soon as it comes from the cattle places the products absolutely under control. The cream can be kept and ripened for butter and *ghi* making and the separated milk is suitable for drinking purposes."* Prolonged experiments and analyses have shown that the milk of both cows and buffaloes yields more butter with modern appliances than in the indigenous process. The results are not equally good for cheese, but this does not signify very much as the consumption of cheese is very limited in this country. The experience of the dairy maintained by the Government for a little time at the Lucknow jail proved that there was a good demand for the separated milk.

* "The Dairy Industry in the United Provinces" by Mir Sayyid Husain of the Department of Agriculture, United Provinces. (Proceedings of the unofficial Industrial Conference at Lucknow, March, 1908.)

Prospects of dairy industry.

237. The best known dairy* in the province is that of Mr. Keventer at Aligarh. The owner was first employed by the Government of Bombay, and when private dairies were established at Bombay and Poona, was placed in charge of two dairies at Aligarh and Lucknow by this Government. He subsequently acquired the dairy at Aligarh. The business, I believe, is doing very well, the principal markets being found at Calcutta and Bombay. The Aligarh dairy is now unable to supply casual customers in this province. Two or three smaller dairies have been started at Aligarh and there are a few at other stations. The obstacles to the expansion of the industry are (1) the contracted milk supply owing to a decrease in area of grazing-grounds and (2) the competition of the dairies established by the military authorities at the cantonment stations. Whether the military dairies are justified in supplying private customers is a question that has often been raised. The first point, on the other hand, is an agricultural one and is being studied by the department. The demand for good dairy products is daily increasing and with the development of railways and postal facilities there appears to be room for economically managed dairies. In spite of the existence of a military dairy farm at Lucknow, that city has two successful private dairies. A small business can be started with a capital of a few thousand rupees. The capital required will be even less if the owner can secure an adequate supply of good milk from the Ahirs of the locality. This is an industry well adapted for educated and enterprising cadets of the landholding classes.

* See *Agricultural Ledger*, no. 17 of 1893.
Also Mr. Mollison's papers, *Agricultural Ledger*, nos. 5 and 6 of 1895.

Chapter XVIII.—Soaps and Perfumes.

Country dhobis' soap.

238. The manufacture of country *dhobis'* soap is carried on in all large towns. There is practically no foreign competition. The chief materials are *mahua* oil, tallow, *sajji*, lime and *reh*, all obtainable in the province. Fatehpur, where the industry was in a flourishing condition at one time, has lost all its export business now. *Mahua* oil, *reh* and *sajji* are the ingredients mostly used at Fatehpur and all these materials are to be had in abundance locally. The exports used formerly to go to Bengal, but factories manufacturing *dhobis'* soap have now been established in Calcutta and Dacca. I think those factories get tallow fairly cheap in Bengal nowadays, and *sajji* can be had from the Benares division and Behar. In Fatehpur there are now only two or three families of soap makers, and their business is exclusively local. It seems that the only way in which the industry in *dhobis'* soap could be developed and organised would be by cheapening the cost of the raw materials. *Mahua* seed, as has been mentioned in the chapter on oils, is obtainable in large quantities in Bundelkhand. Small plants using oil-engines should crush the seed at a much lower cost than bullock-power mills. The process of tallow manufacture at present practised would admit of much improvement. The slaughter-houses at all the chief towns, especially Muhammadan centres and cantonments, yield a considerable quantity of tallow (or bullock and mutton fat). The industry of melting tallow could be easily organised in places like Meerut, Lucknow, Agra and Cawnpore. Clean and up-to-date appliances should be used. They will not only increase the yield of tallow obtained, but mitigate the usual insanitary conditions of country tallow factories.* Several types of modern melting pans can be worked without the use of power or complicated machinery. The tallow industry merits the attention of enterprising Musalman capitalists. The demand for tallow in European countries is very large, and very fair prices are paid for clean and superior varieties. To prevent misapprehension it may be noted that tallow is not an essential ingredient of *dhobis'* soap. I have been told that large quantities of *dhobis'* soap are manufactured at Delhi, Ajmer and Amritsar, the principal materials used being *sajji*, lime and mustard-oil. Even at Fatehpur I came across a man who made *dhobis'* soap without tallow. He claimed that his soap made the cloth wash much whiter than tallow soap. At a place called Lawar in the interior of the district of Gorakhpur a

Tallow.

* A description of the different kinds of plant for melting fat will be found in Andes' *Animal Fats and Oils* (London: Scott, Greenwood & Co.).

large quantity of soap is manufactured by a few Musalman capitalists for export to Nepal. The materials used are *khari* (Glauber's salt), tallow and *mahua* oil. I was unable to get any details of the manufacture or sale.

Toilet soaps the cold process

239. In some of the towns in these provinces, toilet soaps are made in small quantities by what is known as "the cold process."* I found two such factories at Meerut and one at Muttra. Tallow is not used in the composition of these "*pavitra*" or pure soaps. The principal materials are cocoanut oil (imported from Bombay or south India), castor oil (obtained locally), *sajji* and lime. The soaps are perfumed with *khaskhas* and other varieties of country *itr*. No boiling is necessary in the country process in Indian temperatures. The oils are mixed in a pan and warmed and the alkali lye (*sajji* and lime) is allowed to run into the mixture, which is continually stirred. The whole mixture thickens into soap, is kept for several days in frames and is afterwards cut up in the form of tablets. The process is very simple and no elaborate machinery is required. "*Pavitra*" soaps are however in request only amongst orthodox Hindus, and I was informed that the trade was not in a very flourishing condition. The factories are very small, and they must find it difficult with their limited output to compete with machine-made soap.

Modern soa factories.

240. The largest soap factory in the provinces belongs to the North-West Soap Company at Meerut. It was originally started in 1879 and became a limited company in the following year. It has now a working capital of over nine lakhs and extensive premises in Meerut and Calcutta, employing about 500 hands and turning out a large quantity of soap and candles and miscellaneous articles. The factory at Meerut is much smaller than the Calcutta branch of the business. In 1907, it employed about sixty hands daily. With regard to raw materials, the Meerut factory purchases tallow from contractors who obtain it from the large cantonments in the provinces. Linseed and castor oils are used in large quantities. These are also supplied by contractors from various parts of the provinces. Mustard and cocoanut oils are also utilised. The latter has often to be imported from outside the provinces. For the manufacture of the lower grades of soap the factory purchases resin from the Forest department at Bhowali or Chakrata. Local rosin has not so far been found sufficiently good for the higher grades of soap, and the factory has to import some American resin. Alkalis and chemicals such as caustic soda, potash and barium carbonate have all to be imported from Europe. This fact emphasises the necessity of the establishment of alkali manufacture in the country, referred to in a previous

* See Hurst's *Soaps*, pages 215 *et seq.* (London: Scott, Greenwood & Co., 1907).

chapter. For the manufacture of candles, stearin and wax are the principal materials. The wax is imported from Europe and the stearin is manufactured by the company in its own plant in Calcutta. The extent to which an industry in the country is now dependent on foreign products for subsidiary requirements is illustrated by the fact that the North-West Soap Company has to import all the cardboard and lacepaper for its paper boxes, and also imports ready-made pieces of wood for its packing-cases. The only other soap factory in the provinces using machinery and modern methods is the Kaiser Soap Factory belonging to an Indian gentleman at Cawnpore. This factory turns out soaps as well as perfumes. The business is on a comparatively small scale. The proprietor told me he obtained all his materials locally except alkalis. His chief market is in Bombay and Madras.

Prospects of the soap industry.

241. The use of toilet and bar soaps is rapidly extending among the middle classes in the provinces. The capital required for small factories is not large, and the raw materials with the exception of the better classes of alkalis are mostly obtainable in the provinces. The prospects of the industry will of course be very much brighter if (1) the methods for melting tallow are improved; (2) the price of oils is reduced by the extended employment of small power plants; and (3) alkalis are manufactured locally and sold at reasonable prices. Even under present conditions soap factories will pay if properly financed and organised. Within the last few years several small soap factories have been established in Bengal and most of them are reported to be getting on well. The soap industry should afford an opening for enterprising science graduates of these provinces who can command a small capital. A large business can easily be built up from very humble beginnings. It may be mentioned here that a respectable factory will not have much difficulty in obtaining a rebate of duty on the common salt used in the manufacture. It has been represented that the present method of making spirits of wine unfit for human consumption gives it an unpleasant smell, and renders difficult its use for transparent soaps. The matter is under the consideration of the Excise authorities.

Extent of the perfume industry.

242. In perfumes and essential oils the chief branches of the provincial industry are—

(1) rose water;
(2) ottos of various kinds;
(3) *bela* and *chameli* oil;
(4) *khaskhas*;
(5) fragrant sesame or *til* oil;
(6) *sandal* oil;
(7) turpentine oil;
(8) *ajwain* water;
(9) *kcora* or screwpine essence.

Rose-water is manufactured in large quantities in Ghazipur, Jaunpur, Lucknow, Kanauj, Aligarh and Budaun. The roses of the eastern districts are more fragrant, but they are cheaper and grow more luxuriantly in the canal-irrigated tracts. Otto or *itr* of various kinds is made from roses, *khaskhas*, *bela*, *chameli*, *henna* and other perfumes in Ghazipur, Jaunpur and Lucknow. The methods everywhere are primitive and double distillation is not always the rule. *Sandal* oil is now usually the basis. Deodorised mineral oil is also finding favour as a medium. *Khaskhas* grows best in the Doab country and perfumes are made from it in Lucknow, Cawnpore and Aligarh. *Til* or sesame is an important oil-seed crop in Bundelkhand and some districts in Meerut and Rohilkhand divisions. Large quantities are imported to Jaunpur and Kanauj. *Bela* and *chameli* (jasmine) oil is manufactured from *til* by a crude process of enfleurage. Plain *til* oil is also pressed to an increasing extent and exported to Calcutta and Bombay for the manufacture of medicated hair oils now much in demand in the country. The sandal oil industry is in the hands of a few capitalists at Kanauj, who get the wood from Mysore and Coorg. The turpentine oil industry will be described in the chapter on "Lac and Varnishes." *Kewra* water (screwpine) is manufactured mostly at Jaunpur. Mr. D. Hooper* says that this perfume is much sought after by European distillers, but the samples of oil placed on the market are usually obtained by steeping the blossoms in sesame oil, which destroys all the honey-like character of the true odour. *Ajwain* (seeds of *Carum copticum*) water is manufactured by all native druggists for medicinal purposes. All these perfumes and essential oils command a market all over India.

System at pur and Jaunpur.

242. As already mentioned, Ghazipur, Jaunpur and Kanauj in Farrukhabad are the principal centres of the perfume industry. In Ghazipur the chief products are rose-water and rose *itr*. In Jaunpur the manufacturers go in more largely for the various oils with *til* or sesamum as the basis. Roses are cultivated all round the town of Ghazipur by ordinary cultivators who take advances from the manufacturers. Sometimes the latter cultivates a number of fields by his own agency. The roses are gathered between the beginning of March and the middle of April. They are always sold by number, the price varying in normal years from seventy-five to one hundred and ten rupees per hundred thousand. From the data courteously supplied by Mr. G. R. Fox of Ghazipur of a small area experimentally cultivated by him in roses, it appears that the annual value of the produce easily covers ordinary expenses, but in a year of drought or if the winter has been very wet, the yield is not sufficient to pay a somewhat high

* Paper on Indian essential oils. Proceedings of the Calcutta Industrial Conference, 1906.

rent in addition to the cost of digging and pruning. At present there are great fluctuations in the quantity of the produce and the local system of pruning seems to be faulty. The manufacturer of rose-water sets up stills of the type to be found in old-fashioned country liquor distilleries. The boiling pans are often hired by the manufacturer for the season, and he gets them tinned for the occasion. The condenser has no worm in it. The pipe connecting the boiler and the condenser is made of bamboos tightened with rope. Wood is used for fuel in Ghazipur. In Jaunpur some cowdung cakes are also utilised. The process of distillation goes on from the morning till evening. After the distillation is complete the product is allowed to stand and the otto or oil which rises to the top is skimmed with the hand. The same process is followed in the second and subsequent distillations. Six distillations are as much as is done for ordinary purposes. For ordinary otto (not the pure oil or otto of rose), a *sandal* oil base is used. Very little sandalwood is distilled either in Jaunpur or Ghazipur. The oil is imported from Kanauj. The principal firm of Ghazipur gets *sandal* wood from Calcutta and distils oil sufficient for its own needs. Very little rose-water is manufactured in Jaunpur as the soil of the latter place is not so well adapted for the cultivation of roses. Some Jaunpur firms import roses every morning by rail from Benares. For the perfumed oil industry of Jaunpur, *chameli* and *bela* are cultivated in much the same way as roses. The season for *bela* is from April to June and for *chameli* it is June and July. The *til* or sesamum is imported from Karwi and other places in Bundelkhand and also from Moradabad and Chandausi. It is first thoroughly washed and dried. Then it is spread out on the floor in layers with intervening layers of freshly-plucked flowers (*bela* or *chameli*). After a few hours the flowers are changed. Sometimes the same flowers are again spread out over a different lot of *til*, in order to get all the fragrance out of them. The proportion of flowers to *til* is usually one to five by weight. The oil-seed is treated in this manner from a fortnight to a month, according to the quality of oil wanted. When this crude process of enfleurage is complete, some plain sesamum oil is sprinkled over the fragrant *til* and the oil is pressed out in an ordinary bullock-driven *ghâni* or press. The *telis* of the town bring their own presses and bulls to the factory and are paid piece wages in addition to the cake which they utilise as cattle food. The oil is then strained and bottled. *Bela* and *chameli itr* is manufactured in the same way as rose *itr*, a *sandal* oil basis being used. For the manufacture of *keora*-water the same processes are in vogue as for rose-water. The season for *keora* flowers is August and September. Old-fashioned merchants bottle the manufactured perfume in glass *karabas* or phials blown locally in

one or two small factories by Manihars. Old spirit and beer bottles are now coming into fashion. There are three or four large and ten or twelve small firms in Ghazipur and about the same number in Jaunpur. The trade is in the hands mostly of Hindu *gandhis*; but a few Musalman capitalists are also engaged in it. The labourers come from all castes, and a fair number of women find employment in the industry. The smaller factories work only during particular seasons, but the larger factories are open all round the year, treating roses, *belas* and *chamelis* by turn; the fragrant *til* is kept in stock in sacks to be distilled when no fresh flowers are coming in. The products of Jaunpur and Ghazipur are sold mostly in Bengal and Behar and a little finds its way to the Punjab and Rajputana. Some fragrant oil also goes to Bombay and Madras; but rose-water has no chance in western India owing to the competition of Persian rose-water, the sea-freight from Persia to Bombay being much lower than the railway freight from Ghazipur to that port. Sales are as a rule effected by local firms wholesale to the dealers in the consuming areas.

The Industry Kanauj.

243. The town of Kanauj in Farrukhabad has within recent times built up a very large industry in essential oils and perfumes. The sandal oil industry is peculiar to Kanauj. About five or six capitalists import the wood* from Mysore and Coorg and sell in small quantities to local distillers who are mostly Julahas. Sometimes the capitalist makes over the wood and stipulates for the return of a certain quantity of oil. Owing to the dearness and scarcity of wood fuel at Kanauj it is more profitable for the Julahas to take the *sandal* wood to places where fuel is cheap. Thus colonies of Kanauj Julahas go out every season to Gola Gokarannath in Kheri, Mankapur in Gonda, Bahraich and other convenient centres in the Tarai. The distilled oil is brought back to Kanauj and purchased by the large dealers and other perfume manufacturers. The former export the oil to Bombay, whence I believe some portion goes abroad. A number of stills are worked in Kanauj itself. The process of distillation is very similar to that of rose-water. The wood is converted into filings by means of a large iron instrument and the filings are boiled in a copper pan which has been previously tinned. The distillate is received in a condenser which has no worm in it. A big pan takes several days to distil completely. The refuse wood is used for fuel. The processes of the manufacture of rose-water, otto and fragrant oils are exactly the same in Kanauj as at Jaunpur and Ghazipur. About ten large firms and thirty smaller ones are engaged in the industry at Kanauj. The soil round Kanauj is not very good for roses and jasmine, and the want of irrigation is very keenly felt. Rose

* The sandal wood distilled is different from the sandal wood utilized for carving and furniture making.

cultivation pays much better in the Aligarh district and many Kanauj men go out to Hathras, Sikandra Rao and Barwana in the Aligarh district and also to Bilhaur in the Cawnpore district to distil roses there. They dispose of the water locally or bring it to Kanauj. Similarly there is not much cultivation of *keora* or screw-pine in Kanauj. The perfumers of Kanauj migrate for the season to Hyderabad in the Deccan and distil *keora*-water there. A number of Kanauj men also visit the Central Provinces and Berar every year and distil lemongrass oil there. The oil is either exported direct to Bombay or brought over to Kanauj, which is the chief distributing centre for North India. The glass flasks used at Kanauj are imported from Nagina. The small leather flasks are made locally. A subsidiary industry at Kanauj is the manufacture of small wooden boxes to keep perfumes, known as *itrdans*. Carpenters are employed to make the boxes which are stocked by the vendors of perfume. The workmen in the perfume industry are recruited from all castes, both Hindûs and Musalmans. The owners of the firms are mostly Banias and Kalwars. The principal firms have shops or offices in Calcutta, where most of the rose-water is sent. A large amount of business is transacted in small parcels despatched by postal and railway parcel. The value of the scent industry at Kanauj cannot be less than seven or eight lakhs a year.

Foreign competition and suggested improvements.

244. From the inquiries made by me at the various centres of the perfume industry and also in the principal markets of the provinces and in Calcutta it seemed that the business was on the whole expanding. With the growing prosperity of the people, the demand for perfumes is much larger than it was thirty years ago, and but for the competition of imported manufactures, the dealers and workmen of these provinces would have made immense profits. The rivalry with imported goods is however daily getting keener. Prices have to be reduced and the profits and wages in the indigenous industry are both kept very low. Until very recently only imported spirit perfumes like lavender-water and eau-de-cologne had a large sale in the Indian markets. But there have now come into the market ottos manufactured in Germany by the synthetic process with a scent closely resembling the ottos of this province. I found German ottos on sale even by some of the perfume-vendors in Kanauj. The imported perfumes are "softer" than those of this country. They also volatilize much more quickly and impart the odour to a larger area than local perfumes. These qualities recommend them to men of the "new style." The competition of the German ottos has not yet assumed very serious proportions, but should serve as a warning to native manufacturers to set their house in order. The

introduction of up-to-date methods and processes* is very desirable. Perfumes have also to be presented to customers in attractive bottles and cases. This is a point which has not yet received sufficient recognition from manufacturers in these provinces, although a few Calcutta firms have adopted such expedients. In the indigenous processes themselves many improvements can be easily effected. The furnaces should be provided with flues for the regulation of air and should be adapted for the utilisation of coal as fuel. In all plains districts now, wood fuel is becoming scarce and expensive. I think economy of fuel will also be secured by embedding the boiling pan in a brick wall instead of leaving it exposed to the air as now. The condenser should undoubtedly be provided with a worm. Instead of the bamboo pipe between the boiler and the condenser, a glass or metal pipe will probably be an improvement. The condenser is now placed in a common earthen vessel containing water. This water is not changed as frequently as it should be. If the condenser could be immersed in running water the results will probably be much more satisfactory. Some mechanical means should be adopted for separating the otto from the rose-water. The water could probably be drawn off by means of a stopcock at the bottom of the condenser. The present methods of enfleurage adopted for impregnating *til* with scent are very crude. Technological research is needed to ascertain whether the system of enfleurage adopted with lard in Southern France could not be so altered for the purposes of this country as to substitute *til* (either crushed or uncrushed) for lard. As mentioned above a real essential oil of *keora* will find a European market which the present otto in sandal oil does not. All these suggestions would require careful experiment in order to ascertain whether they are economically sound. The men at present engaged in the perfume industry have a good deal of enterprise, but do not possess the requisite knowledge or training. For instance one manufacturer at Kanauj tried a worm in a condenser, but failed because the worm was not properly constructed. Other men have told me that they would gladly manufacture spirit perfumes if they knew how to. The obvious method of improvement is for a young man with some education to acquire a thorough working knowledge of the actual conditions of the local industry and then to proceed to Europe to study improved methods and processes. I would also recommend experiments by the agricultural department in the cultivation of the flowers most used for the local manufacture of perfumes. Better advertisement of

* Persons desirous of studying western methods and recipes should consult—

(1) Gildmeister and Hoffmann's *Volatile Oils*, published for Messrs. Schimmel & Co., of Leipzig by the Pharmaceutical Review Publishing Co., of Milwaukie, U.S.A., 1900.

(2) Atkinson's *Perfumes and their Preparation*. Norman Henley Publishing Co., New York, 1907.

their goods is likely to enlarge the market of country perfume vendors. A system of commissions will probably induce respectable shopkeepers in all towns to stock them. It is difficult to procure country-made perfumes in the smaller towns nowadays. The subject of railway freights as they affect the industry in soaps and perfumes has been dealt with in a separate report.

Manufacture of new perfumes.

245. Besides those already mentioned it would be possible to manufacture other perfumes from raw materials available in the provinces. Cassie flowers* (*Acacia farnesiana—Bilaiti babul*) are abundant in the lower hills and the Tarai, and may be cultivated along with tea. Cassie pomade made out of this flower is much used in European perfumery. A planter in Naini Tal used to prepare cassie pomade and send it to London, where it was highly valued. The trade was stopped by his death. An European gentleman has taken the lease of a forest of *Acacia farnesiana* from the Balrampur estate in the Gonda district. The residents of surrounding tracts also bring flowers to him. It is believed that about one thousand maunds of flowers are dealt with annually. I was unable to ascertain details about the local processes. The product is shipped abroad. I have been told that there are scattered plantations of the cassie tree in Government forests and that the tree can be easily grown. The matter may be studied by the Forest department.

The essence of *champa* (*Michelia champaca*), if properly prepared, would also command a good market. It is a common garden tree in the plains.

Essences† could also be manufactured from the following:—

(1) *Mesua ferea* or *nagkesar*.

(2) *Mimusops elengi—maulsri*.

(3) *Nyctanthes arbortristis—harsinghar*.

(4) Basils—*tulsi*.

(5) Piper betel—*pan*.

* See Watt's *Dictionary*, volume I, page 48; also *Agricultural Ledger*, No. 2 of 1902.

† See Mr. Hooper's article referred to above.

Chapter XIX.—Lac, Varnish and Paints.

Traffic for lac.

246. The magnitude of the lac industry in the provinces may be judged by the fact that in 1905-06 the imports weighed 249 thousand maunds and were valued at 139 lakhs of rupees, while the exports amounted to 164 thousand maunds valued at 155 lakhs of rupees. In the following year the imports amounted to 181 thousand maunds valued at 101 lakhs of rupees and the exports were 183 thousand maunds worth more than 165 lakhs of rupees. Mirzapur is practically the only centre of the industry in the provinces.

The imports to Mirzapur are mainly in the form of the raw material (stick lac) while the exports go in the shape of finished products like shell lac and button lac. The figures quoted above for exports exclude lac bangles and beads and lac dye, which are classed under other heads in the traffic returns. During the last three years there has been a rapid growth* in the demand for shellac and button lac in the markets of the United States, United Kingdom, Germany and France. The export of shellac and button lac has increased in comparison with stick and seed lac and the prices have in many cases been regulated by speculation.

Cultivation lac.

247. There is no systematic cultivation of lac in the United Provinces.† It is principally collected from *palas* or *dhak* (*Butea frondosa*), pipal (*Ficus religiosa*) *siris* (*Albizzia lebek*), *kusum* (*Schleichera trijuga*) and *khair* (*Acacia catechu*). Manihars and other castes gather the lac from the trees, paying a royalty to the owner. With the exception of a small quantity consumed locally all the lac collected is exported to Mirzapur, where good prices are obtained. The forests in the south of Mirzapur yield a small quantity of *kusum* lac. About half the supplies of Mirzapur are drawn from Manbhum and adjacent districts in Bengal. The rest of the raw material comes from the Central Provinces and Berar, from these provinces and a little from Assam. There are two principal crops, gathered in May and October. It would appear that with more attention a much larger quantity of lac could be grown in the provinces as many of the well-known lac-bearing trees are abundant in various localities.‡ The matter deserves the attention of enterprising landowners.

* See the *Review of the Trade of India*, 1905-06, page 42.

† See Stebbing's *Note on the Lac Insect*. Indian Forest Records, Vol. I, part I, 1905.

‡ See Stebbing's *Note on the Lac Insect*, page 7 *et seq.*

A note on certain improvements in lac manufacture has, I understand, been written by Sardar Puran Singh, acting Imperial Forest Chemist, and is in course of publication.

Lac manufacture in Mirzapur.

248. The lac industry gives employment to a large number of men and women in Mirzapur. In 1907, there were four European factories employing nine hundred hands and thirty-eight large native factories with nearly two thousand and four hundred hands. Besides this there are a number of smaller native factories, employing about a thousand hands altogether. None of the factories at Mirzapur use steam-power like the European factories at Cossipore and Maniktala in the neighbourhood of Calcutta. The processes in vogue at Mirzapur are the same in the native as in the European factories. These operations are fully described in an able monograph* on lac by Sir George Watt. The different forms of lac in commerce are—

(1) Stick lac. | (3) Shellac.
(2) Seed lac. | (4) Button lac.
(5) Garnet lac.

Stick lac is the crude material, *viz.* small pieces of twig or bark incrusted with the lac. It is received in this form in the factory, where the first process carried out is the separation of the lac from the woody matter. The twigs are crushed in a mill (nowadays mostly worked with a powerful lever). The wood is then sifted by hand and with sieves and subsequently used as fuel. The lighter portion is again subdivided into granular lac and *khud* or particles of lac mixed with dust. This separating work is usually performed by women. The *khud* is sold mostly to bangle-makers. The granular lac is placed in large tubs with water and after twenty-four hours the workmen tread the material in the tubs; the colouring matter is thus extracted from the lac and passes into solution; this operation is repeated several times until a clear wash water is obtained. The first wash water is evaporated and subsequently pressed into *lac dye*. The lac obtained after the treading operation has been completed is called *seed lac*. It is thoroughly dried and the lighter portions which contain a good deal of dirt are again sifted out and sold to bangle-makers. In order to manufacture shellac, the pure seed lac is mixed with orpiment (*hartal*) and resin. The addition of resin lowers the melting point of the lac and a certain proportion of resin is allowed by the rules of the trade in all samples of shellac. American resin imported through Calcutta is used. The mixed lac and resin is placed in long cylindrical bags made of cotton cloth of a medium texture. The bag is heated in front of a large fire and twisted by the two men holding it. The molten lac oozes out, is scooped up by the principal workman and deftly stretched out over an inclined porcelain tube filled with hot water. It is then further stretched out by a man

* *Agricultural Ledger No.* 9 of 1901.

who uses his hands and feet to hold it at the different ends. The stretched sheet is the *shellac* of commerce. The best quality is orange shellac. Each well-known maker has a mark of his own, like D.C., T.N., etc.

The inferior qualities of seed lac are usually made into *button lac* which differs from *shellac* in being set in small round pieces instead of in sheets. *Garnet lac* consists of thick flat pieces containing more colouring matter than either shellac or button lac. It is used mostly for making dark-coloured varnishes. There is a growing demand for button lac for gramophone records.

Uses of lac.

249. At one time lac dye was the chief commercial product of lac, but since the invention of coal tar dyes it has practically become a waste product, its chief uses being confined to colouring toys, and as a cosmetic for Hindu women. The fashion for lac bangles and beads is also disappearing. They are still made in small quantities in some towns like Lucknow, Ghazipur and Benares, but their use is now considered vulgar by the majority of Indian women. As has been pointed out above only the worst qualities of lac are used by the bangle-makers. I was told by a leading lac manufacturer of Mirzapur that the total consumption of good lac in India would not exceed a thousand maunds.

The chief industrial uses of lac in this country are (1) by carpenters, cartwrights, and turners as a varnish or colour medium. Oil varnishes have so far been mostly in use, but spirit varnish is now often utilized; (2) by silver and coppersmiths and potters, bookbinders and makers of *huqqa* pipes both for ornamentation and as a stiffening medium; (3) for sealing wax; (4) for lacquer work or lac turnery; (5) for coloured metal ware such as produced at Moradabad. In Europe it is used extensively as a varnish and polish for furniture and metal, as a stiffening material for hats, as an ingredient in lithographic ink, as sealing wax and for gramophone records.

Condition of th trade.

250. No improvements in the indigenous processes of lac manufacture have suggested themselves to me. The subject requires investigation by technological experts. The trade is however at present on an unstable basis. The supply of the raw material varies from year to year and there are violent fluctuations in the prices of the finished product. The first point can be remedied only by a more systematic and widely extended cultivation of lac in the provinces. As regards the second point, it is obvious that prices in foreign markets can be controlled only if there was an adequate home demand for lac. The present consumption of lac in India is negligible. There is however a wide field for its employment in the manufacture of varnishes.

It is already used to a very small extent by carpenters in making crude varnishes, but the industry should be organised on an adequate scale.

Proposed manufacture of spirit varnish and industrial alcohol.

251. As has been recently pointed out* the consumption of spirit varnish is rapidly extending in India "as a consequence of the widespread use of European furniture in Indian houses, and very large quantities are imported for use in carriage building, in railway and other workshops, and the like. India with her dominant position in respect of the raw material ought not only to be self-supplying in spirit varnishes, but also to furnish others with manufactured products, if she possessed a supply of cheap industrial alcohol in sufficient quantities." *Mahua* trees abound in the forests of Mirzapur and the adjoining districts of Bundelkhand. The *mahua* flower is a good and cheap spirit base. It ought not to be beyond the enterprise of the large landholders of Mirzapur to adopt the latest appliances for the manufacture of industrial alcohol out of *mahua* and in combination with shellac to turn out spirit varnish. The industry if properly organized and managed is sure to be a profitable one. If a number of sugar refineries on a large scale be started in the province, the refuse molasses, which are now mainly utilized for tobacco manufacture, could also be used for the production of industrial alcohol.

This industry would also help the soap and perfume manufactures of the province. Industrial alcohol could also be manufactured from rice, which is grown in the eastern districts of the provinces. The question as to which would be the most economical method of manufacture can be determined only by prolonged experiments on a commercial scale. The subject should be taken up by the technological experts to be employed in the province. Some of the capitalists in Mirzapur whom I consulted seemed to think that *shira* would be a cheaper base than *mahua*.† They also expressed a doubt whether the industry will be profitable unless a rebate of duty was granted for the alcohol used in the manufacture of varnishes. In most western countries only a nominal duty or no duty is now levied on alcohol denatured for industrial purposes.

Manufacture of other varnishes. Turpentine and resin industry in Government forests.

252. Among the other bases for the manufacture of varnishes the principal are linseed oil and turpentine oil. It has been pointed out in the chapter on oils and oilseeds how linseed is one of the principal raw products of the provinces. The manufacture of linseed oil is likely to be a paying industry. The manufacture of turpentine has already been going on for several years on a small scale in the Government forests at Dehra Dun and at Bhawali in the Naini Tal district. So far as can

* *Indian Trade Journal*, April 4, 1907.

† I hear a country liquor manufacturer at Ranchi in Bengal is importing patent stills to manufacture industrial alcohol.

be judged from the results of the last ten years' work the tapping of the pinetrees has not in any way injured the quality of the timber, but further experiments are in progress in the matter. The products are rosin of two qualities and turpentine. The rosin is purchased by soap factories in India, but I have been told by managers of soap factories and paper mills that the quality is still inferior to that of American resin. The quality of the turpentine has been reported to be excellent and it is readily purchased by chemists for medicinal purposes, by railway companies and by Government departments. I venture to think that the industry should be developed as rapidly as possible. The question of handing over the manufacture to private enterprise has recently been under the consideration of the Government.

Paints colours indu

253. There is at present no organised paint and colour factory in the provinces. The consumption of paints and colours is rapidly extending in all parts of the country for building materials, carriages and vehicles, lamp posts, garden seats and other wood and metal articles. The provinces are rich in the raw materials of drying oils. An investigation is desirable by technical experts into the commercial possibilities of a local manufacture of paints.

The traini painters.

254. The profession of a painter (*Rangsaz*) is followed by a limited number of artisans in the large towns and their services are in great request. In the smaller towns it is impossible to get any painting work done without importing artisans from outside. The painters obtain very little technical training. Considerable improvements are always possible in the mixing and the laying on of the paints and colours. I would suggest the industry of painting being taught in some of the industrial schools in the provinces.

Art painti Shahjahanp

255. There is a small industry in art painting in the district of Shahjahanpur. Ten Musalman families in Shahjahanpur town and fifteen families in Tilhar are engaged in the trade. The original industry consisted of the painting of *palkis* and *charpoy* legs, of the earthen pots in which presents of confectionery are sent by rural residents, and of bamboo baskets covered with cloth or leather. All these branches of the industry are still flourishing. About twenty years ago was introduced the art of painting wooden articles *de luxe* like occasional tables and wall brackets and also of painting brass trays. The painter always purchases the raw material (a table or a basket) and restricts his own operations to pure painting. In the case of wood work a coat of some mordant is first applied. A black or white ground is then obtained with a suitable paint. A pencil drawing is subsequently made of the pattern to be painted and the colours are laid on with a thin brush. Metallic colours are mostly

used. The polish is imparted with spirit varnish. The patterns so far as I could judge are crude and garish and the colours become dowdy and tarnished after a few years. There is very little demand nowadays for the art produce. I am afraid the prospects of keeping alive this industry as an art are very slender. The painters have however much natural aptitude and are likely to make good artisans in an ordinary painting business.

Chapter XX.—Tobacco and Catechu.

Cultivation of tobacco and traffic.

256. Only country tobacco is manufactured in the province. The average area under tobacco in 1903 to 1905 was 67,000 acres, showing only a very slight increase over the average area of 1893 to 1895. The districts with the largest area are Meerut, Bulandshahr, Aligarh and Farrukhabad. The traffic returns are as below:—

	Imports.				*Exports.*			
	1901-02.		1905-06.		1901-02.		1905-06.	
	Thousand maunds.	Thousand rupees.	Thousand maunds.	Thousand rupees.	Thousand maunds.	Thousand rupees.	Thousand maunds.	Thousand rupees.
(1) Unmanufactured ...	3,67	22,48	4,20	35,65	71	4,93	1,52	7,42
(2) Cigars	1	32	·07	46	Negligible.			
(3) Other	4·2	1,24	7·6	2,18	8	1,19	9	1,44

The greater part of the unmanufactured tobacco comes from Bengal and nearly half of it is taken by Benares, where it is converted into snuff and *zurti* to be eaten with betel leaf. There is also some perfumed country tobacco manufactured in Jaunpur and Lucknow. The export of unmanufactured tobacco is almost entirely from the tobacco districts named above to the Punjab and Rajputana. The head "other" comprises, I think, mostly cigarettes, of which the consumption has much increased in late years.* They are imported mainly through Calcutta.

Country tobacco manufacture.

257. The snuff and *zurti* of Benares are the principal forms of manufactured tobacco exported from the provinces. A certain amount of country smoking tobacco is also sent from the chief tobacco-growing districts to Rajputana and Central India. The chief ingredients of tobacco manufacture in these districts are the powdered leaf, *reh*, and *shira* or refuse molasses purchased from the large sugar refineries. The processes of country tobacco manufacture are very simple and need not be described.

Manufacture of cigars and cigarettes.

258. There was a large tobacco farm in Ghazipur in the seventies and eighties managed first by Government and afterwards by Messrs. Begg, Dunlop & Co. The

* The imports of cigarettes to India increased from 21 lakhs in 1901-02 to 45 lakhs in 1905-06.

experiment of curing tobacco for shipments to Europe was given up because* owing to the dry climate and light soil the leaf produced was graded with the medium and lower qualities of American tobacco and the prices realized were disappointing. The Board of Agriculture at their meeting in January 1906 came to the conclusion that this province could not look for an industry in manufacturing tobacco for European consumption. The use of very cheap cigarettes is however increasing very fast among all classes of the Indian population. The cigarettes now sold are as a rule of imported leaf. Unless locally grown tobacco can be made up in the form of cigarettes, the cultivation of tobacco is likely to suffer. A large factory has been recently established in Behar with American capital, which I understand intends to utilise local tobacco for the manufacture of cigarettes,† It is desirable that the suitability of the tobacco of these provinces for cheap cigarettes should be ascertained. Under the orders of the Government inquiries are being made in the matter, but no definite results have yet been obtained.

Consumption of catechu.

259. Catechu or cutch (*khair* or *katha* in the vernacular)‡ is a product of the Kumaun forests. It is used in this country very largely as an astringent with *pán* or betel leaf and is also exported to Europe where it is employed as a dye, in calico-printing and as a tannin. During 1906-07 the imports of catechu into the provinces came to 13,179 maunds, valued at two lakks and thirty thousand rupees. The exports amounted to 22,733 maunds, valued at five lakhs and eleven thousand rupees. Cawnpore is the great distributing centre. The imports came mostly from Bengal and Central India while the bulk of the exports went to Bombay, the Deccan and the Central Provinces.

Area of the catechu industry.

260. There are extensive areas under khair (*Acacia catechu*) in the reserved forests situated in the Kumaun-Bhabar tract. These have been worked for many years past. The forests in Eastern Oudh (Gonda and Bahraich) have also large *khair* plantations, but they generally occur in riverain areas and in broken situations where denudation is proceeding very rapidly. The felling of the *khair* trees in such tracts is likely to hasten the washing away of the surface soil. Consequently no manufacture of catechu in this area was allowed for a long time. In the winter of 1908, owing

* See Proceedings of the Board of Agriculture in India, 1906, page 114.

† See also Report of the Imperial Department of Agriculture, 1906-07, page 19.

‡ See Agricultural Ledger—

No. 1 of 1895.

No. 2 of 1896.

No. 35 of 1896.

No. 2 of 1902.

to the prevailing scarcity, catechu manufacture was permitted and it gave employment to several thousand persons. There are some private *khair* forests in Oudh which are regularly worked. A large quantity of *khair* is also manufactured in Nepal close to the borders of these provinces.

Present methc of manufacture.

261. The processes of manufacture are very crude and primitive and are practically the same everywhere in these provinces. The workers are known as *khairas* and are recruited from several castes, Bhars, Jogis and low caste Musalmans forming the bulk. They encamp and construct their kilns wherever there is a water supply. The men go out into the forest and fell the trees after a preliminary test by making a notch in the stem to ascertain whether it is likely to yield sufficient catechu. The bark and sapwood are used as fuel. The selected portions of the heart wood which are considered to be rich in catechu are chopped up into small chips about two cubic inches in size and brought in sacks and baskets to the encampment. The kiln holds a number of earthen pots or *handis*. The chips are placed in these pots, covered with water and boiled in the open air. After the first boiling of three hours, the liquid is decanted into a second pot which is again boiled for three hours. It is then poured into a third pot and boiled until a thick semi-liquid stuff is obtained. After cooling the infusion is poured into a wooden trough where the process of cooling is continued It is then emptied into a pit of which the bottom is filled with a layer of sand in order to draw off the remaining water from the catechu which takes about a month to attain the consistency of clay. It is afterwards taken in large pieces of about ten pounds and finally dried in the sun and cut up into smaller cubes in which shape it is marketed. The boiling and cooling processes are generally attended to by women assisted by children.

Possible improv ments.

262. The great obstacle to the successful manufacture of catechu in the Bhabar is the shortage and frequent entire absence of water. As has been pointed out by Dr. Leather,* "it would be more economical to reduce the wood to shavings by the carpenter's plane rather than to cut it into chips as at present. When reduced to shavings the yield of catechu tannin and of catechu was much higher than with chips; the quantity of water to weight of wood could be reduced from 20 to 10 or even less; and the duration of boiling might be reduced from twelve hours to half an hour. All these circumstances indicate not only vast financial economies but the production of a superior quality of extract owing to the smaller amount of boiling that is necessary." Attempts made so far to persuade the *khaira* to substitute the spoke shave for the axe or *dah* have been of no

* Agricultural Ledger No. 2 of 1911. *Acacia spp.*, pages 84 and 85.

avail. If the extract be treated in a filter press and dried in vacuum pans, a much purer cutch will be obtained. It does not seem likely that the Khairas will adopt these methods unless a more enlightened class of capitalists enter the business and direct the operations paying the workmen daily or piece wages. The girth of trees that can be felled has recently been reduced from four feet to two feet and a half and it is estimated that in the Bhabar tract, some sixty thousand trees will be available in 1908 as against less than six thousand trees felled in the current year. The system of levying royalty has also been altered so as to prevent needlessly wasteful methods. The business is therefore likely to expand considerably and merits the attention of capitalists. At present the Khairas are financed by Banya capitalists from Lucknow and Cawnpore who advance money at a very high rate of interest and take over the finished product at a comparatively low rate. The Khairas seem never to be able to pay off their debts to the dealers. Considering that the Khairas do not belong to any single caste and are very backward in their ideas and habits, I do not think it will be possible to introduce any real system of co-operation amongst them for a long time to come. The only way to improve the industry as well as the condition of the workmen is the introduction of a better class of capitalists.

Chapter XXI.—Gold and Silver Ware.

Native jeweller.

268. Gold and silver jewellery for the people is usually made by a local *sunar* in every town or large village; very often at the house of his customer. No estimate can be made of the extent of the industry from the traffic returns, as a large proportion of the jewellery is made out of old molten stuff, or from the census figures because all *sunars* are not necessarily gold and silver smiths. In the large towns there is a growing tendency to discard the old heavy native patterns * for the lighter European style of jewellery. In Benares and to a smaller extent in other large towns silver *howdas*, chairs, palanquins, tonjons, etc., are made and are subsequently upholstered with brocade and velvet embroidery. A fair number of workmen are employed in the industry, but the designs are garish and the outturn is declining every day.

Art ware.

264. As regards artware the business of the *tarkash* (wire maker) and *kalabatun* (gold and silver thread) maker, which was at one time a flourishing industry in Lucknow and Benares, is declining very fast on account of the competition of European imports. The matter has been referred to in the notes on the silk industry. Lucknow is the principal centre in the province for art silver. The demand among native patrons has much decreased owing to—

(1) the modern taste among the wealthier classes to patronize western styles;

(2) the preference shown by the middle classes for cheaper and more useful articles.

The sale among European visitors and tourists has also contracted owing, I was told, to a heavy import duty in the United States and the Continent of Europe, but mainly I fancy on account of debased designs and inferior workmanship. The trade is in the hands of middlemen. The actual workman never gets into touch with the customer. The shopkeeper gets silver ingots from Bombay or buys from a local *sarraf* and gives it out to the workman, who is paid either contract wages or daily wages (ranging from four annas to two rupees a day). The native purchaser usually gets articles made to order, but a stock has to be kept of articles of European style. The Lucknow silversmith is gradually abandoning the native jungle design for designs borrowed from other parts of India. In *bidri* ware (the damascening of silver on lead) there has been a very great decline. Europeans have given up patronizing this art,

* See the monograph on *Gold and Silver Ware* by Mr. A. P. Charles, C.S.

while Indian gentlemen give only occasional orders for *huqqas* or salvers. The artizans work at contract rates. Both in ordinary silver and in *bidri* work it is difficult to introduce new or original patterns, for artizans charge high wages if they have to do anything but copy and competition with the cheaper ware of Delhi (alleged to contain less pure silver) has cut down prices very low. In Lucknow the small subsidiary industry of enamelling is now practised by less than a dozen artisans. The enamel or *mina* is imported and the enameller who is usually a Sunar by caste is supplied with half finished gold or silver articles by the ornament makers. After the letters or figures have been engraved with a chisel, the enameller puts the enamel in and places the article in a low fire. It is afterwards cleaned and returned to the ornament maker.

gestions.

265. In view of the very great disproportion between the value of the material and the wages of labour, the industry in gold and silver ware can be carried on only by capitalists. In the case of native jewellery the customer as a rule advances all the raw material. The chief requirement at the present day is an improvement in designs. This it is hoped will be to a large extent accomplished through the school of designs to be established at Lucknow. In the presidency towns, native firms have taken to the manufacture on a fairly large scale of jewellery of light European patterns. They employ many labour-saving appliances such as dies, rollers and punches. With the change in fashion amongst the upper and middle classes in the country the need for such firms will be felt in these provinces also. The art products are likely to regain favour if the gold and silver were not quite so soft as now. Much improvement is also possible in the polish and the finish of the goods. A very large quantity of gold and silver articles are now imported in the shape of watch chains, scarf pins, studs and links, cigarette cases and holders. All these can be easily manufactured in the country and kept in stock in shops in the large towns. There is a growing demand for electroplated goods and the industry if properly organised will give employment to a large number of artisans. It has been already discussed in the chapter on brass and copper.

and the artisans there numbering nearly a hundred, besides manufacturing combs of an ordinary quality, are capable of turning out pretty and ornamental combs. Combmakers (*kanghiwalas*) are also to be found in small numbers in many other districts. There are several families in Etawah and about a dozen families at a village called Kataina in the district of Mainpuri. In Shahjahanpur I found three shops of horn combs. The horn of the buffalo only is used for comb making. Cow horn is believed to be too tough and inelastic. The processes are everywhere the same. The horn is obtained from the slaughter-house butcher. The tips are cut off and ultimately find their way to Europe, where they are used for knife and umbrella handles, buttons and the tops of whips. The remaining portion is cut into small thin slices of the size and thickness of the combs to be manufactured. These slices are cleaned and then softened by heating gently over a charcoal furnace. The slices are afterwards straightened by pressure in a rude press under a wooden beam. They are subsequently cleaned and smoothed with fine chisels and files, and then polished with a piece of mat or charcoal. The teeth are made by means of a saw and sharpened with a three-foiled instrument. The comb is again polished and is ready for the market. Common combs are sold wholesale at about four rupees per hundred. The finer combs are coloured with various dyes. I think a good many simple improvements could be introduced into the processes of horn manufacture. In Europe horns are softened by throwing them into water and subsequently immersing them in an acid bath for a period of two weeks. I think this process of softening yields better results than heating. An improved press is also very desirable, and if it is expensive, very probably it could be worked on a co-operative basis. Improved tools should also be used in separating the tips from the horn and in sawing the teeth. In Europe the cutting of the teeth is performed by a parting engine or die-stamping machine in the case of coarse combs and by circular saws in that of fine-toothed combs. Horn is easily dyed and in this respect also the products could be made more attractive. To show the way to the poor and illiterate artisans it is desirable that some small capitalists with education and enterprise should join the industry and introduce improved methods. A small factory worked by electrical power in Calcutta turns out excellent combs from buffalo horn, and I hear another factory has been started at Cuttack in Orissa. Articles other than combs could also be manufactured from horn, *e.g.* knife handles, shoe-horns, knobs for drawers, scoops and drinking cups.

269. There is very little industrial use of bones in these provinces. Considering the amount of hides exported every year the supply of bone must be very large.

Formerly the bones were allowed to go back to the soil. During the last ten years a fairly large export industry has been developed. Bones are collected from slaughter-houses and the fields by the lowest castes and sent down to the ports where they are converted into meal and shipped. The export of bone deprives the soil of a very necessary ingredient and it will be much better if it is worked up locally and eventually allowed to return to the soil. At present the only local industries in bones are of a very trivial character. In Lucknow two or three families utilise the shinbones of camels for small articles like paper knives, pen handles and bookmarks. A sale is effected on railway platforms. These men sometimes work in ivory also, but their capital is very limited and the ivory bears no comparison with the ivory in ivory bangles or bracelets at Sitapur for instance. In Shahjahanpur, some use is made of bones for knife-handles, and in Etawah the combmakers sell one that they occasionally utilised camel bone. There is a large consumption of bones in the province, and it should be possible to develop an industry in the manufacture of bone buttons. Among other articles that could be made out of bone are combs, knife and fork handles, card cases, pencil handles and bookbinders. At present the industry in bone buttons and other bone articles is mainly carried on in France and Germany.

Other slaughter house industries.

270. I have in the chapter on soaps and perfumes referred to the manufacture of tallow. Very little hard fat is made in this country and in the present condition of the cases which handle this article any large development of this industry cannot be hoped for. There is plenty of room for the manufacture of glue and gelatine from the refuse products of the slaughter-houses and carcases. I do not think any attempt has been made to manufacture glue by scientific processes in these provinces. In view of the large amount of the raw material, the industry is worth looking into by men with some technical knowledge. Even the larger slaughter-houses in the provinces deal with at present in Bombay, whence I believe it is shipped to Europe for the manufacture of albumen fertilizers and gelatine products. I doubt if it will be possible to develop an industry in this country. Even the fat collected in the slaughter-houses and shipped to Europe is used in the manufacture of soaps.

271. There is a small industry in the town of Etawah in the manufacture of *Feather trade.* feather fans. A similar industry in Farrukhabad has now practically died out. In *Etawah.*

Etawah, it supports fifteen Baheliya families. The feathers are imported by dealers from Rajputana, Agra and Bundelkhand. Men, women and children all work at the craft. Excepting a small wooden handle, everything is made of feather. Coloured as well as uncoloured feathers are used. Dealers purchase the fans and export them to Calcutta and to the Punjab. There does not appear to be any room for development in this industry.

Sola hats.

272. The use of *sola topis* is growing every day. There is a very small industry near Roorkee in the manufacture of *sola* hats out of a kind of pith (*Æschynomene indica*) obtainable in the locality. Sola hats are manufactured in Allahabad, and also near Jais in the district of Rai Bareli. The industry is dependent on the supply of the raw pith which is to be found in large tanks and *jhils*. There was very little water in the *jhils* during the last two years; consequently the local manufacture of sola hats received a check. I cannot tell if the growth of the plant in the *jhils* can be artificially stimulated in any way.

Clocks, watches and spectacles.

273. The use of cheap clocks and watches is continuously expanding. The many hospitals in the province have also created a demand among the poorer classes for spectacles. I doubt if it would be possible in the near future to manufacture watches and clocks in this country to compete with Switzerland and the United States. A very large capital and production on an immense scale would probably be necessary for this purpose. I have heard though that the hand manufacturers of south Germany are holding their own in this industry. There is in these provinces already a fairly large industry in repairs. The work is usually ill-done because no proper agency for teaching the trade exists at present. The industry is deserving of attention in connection with the scheme of technical instruction.

Matches.

274. The consumption of lucifer matches, now mostly imported from Sweeden and Japan, must be enormous, but this article is not classed separately in the provincial traffic returns. A small match factory was established at Saharanpur some years ago but soon stopped work for reasons which I have not been able to ascertain. Fairly decent matches (both safety and friction) are now made by the Gujrat Islam Factory at Ahmedabad, which are sold in some shops in this province. A match factory has been in existence for some years at Kotah in Bilaspur (C. P.) and is said to be doing well. Another factory has been started in Calcutta. Within the last few years there has been some import of match-making machinery into India.* It is impossible to make any estimate of the possibilities of the industry in

* See report on the Maritime Trade of Bengal, 1906-07.

these provinces without definite information about the supply of locally available suitable wood.

Attention has been directed to the following timbers:—*

(1) Pines.

(2) Himalayan silver fir.

(3) Himalayan spruce.

(4) Silk cotton tree—*Bombax malabaricum.*

I have been informed this tree is plentiful in the Domains and zamindaris of the Maharaja of Benares.

(5) *Amra—Spondias mangifera.*

(6) *Lasora—Cordia myxa.*

(7) Bamboos for match boxes.

In 1906-07, the Forest department sent specimens of the wood of *Trewia nudiflora* and *Salix tetrasperma* to the [illegible] match factory. Both samples were favourably reported on as suitable for matches and match boxes. These two trees are said to be very abundant in the open miscellaneous forests. The subject is being studied by the Imperial Forest Economist at Dehra Dun, and a publication will soon issue from the Forest Research Institute. It is possible that suitable wood may be found in localities where it will not pay to convey chemicals for the last stages of the manufacture of matches. In such a case I would suggest the division of the industry into two branches. At the place of supply of the wood, factories should be set up for the manufacture of splints. The finishing processes can be conducted at easily accessible centres where the splints are brought down from the first factory.

[illegible]. Attention may also be drawn to the manufacture of pencils and penholders. The creation of this industry also depends to a large extent on the supply of suitable wood, although packing cases and the chips thrown away at carpenters' shops may perhaps be utilised to some extent. In Calcutta a small factory has been working during the last two years with electric power, and it turns out excellent penholders. When visiting this factory I was told that some of the wood utilised, especially that of the [illegible], was imported from these provinces and the lacquer work on the holders was done by hand by artisans belonging to these parts. The penholder industry may be able to utilise the chips of [illegible] thrown away by lacquer workers in many towns. Pencils and penholders.

* [illegible]

† [illegible]

Writing and printer's ink.

276. So far as I am aware there is no organised manufacture in the United Provinces of writing ink or printer's ink. The consumption of both kinds of ink is already large and will increase very much in the near future. Large quantities of ink are manufactured in Calcutta and its neighbourhood. Many of the raw materials* such as tannins and linseed oil are available in these provinces, and there is no reason why ink factories should not be started here.

* See Lehner's Ink Manufacture (London: Scott, Greenwood & Co.) and Livathe and McIntosh Manufacture of Varnishes, pages 327 *et seq.* (London : Scott, Greenwood & Co., 1899).